S92 0.218

SHORTESS

PRESCRIBED BURNING - A RECREATION MANAGEMENT TOOL

Professional Development for Outdoor

Recreation Management

1986 - 1987

Laurie L. Shortess
U.S. Forest Service
DeSoto National Forest
Chickasawhay Ranger District
Laurel, MS

ABSTRACT

There are many different needs and opportunities for vegetation manipulation in planning and providing for a broad spectrum of recreation opportunities from wilderness to highly developed recreation sites.

In an effort to look at how managers can best utilize prescribed fire in recreation planning, this paper examines fire history along with traditional as well as current uses throughout the country with some emphasis to the southeast. Complete discussion of environmental effects, visual considerations, public perception along with some practical recommendations are intended to assist other managers as they attempt to determine where this valuable management tool can best meet their needs.

TABLE OF CONTENTS

Page

CHAPTER I

Introduction 1
Statement of the Problem 2
Description of Study Area 3
Hypothesis 6
Objectives 6
Assumptions 7
Limitations 8

CHAPTER II

Review of Literature 9

A. Effects of Prescribed Fire in the Southeast 9
1. Effects on Vegetation and Fuels 10
2. Effects on Soil 12
3. Effects on Water 14
4. Effects on Air 15
5. Effects on Fauna 17

B. Effects of Prescribed Fire on Visual Resources.. 19
C. Effects of Prescribed Fire on Recreation 20
D. Alternatives to Prescribed Fire 23
E. Public Perceptions, Education and Fire 25

CHAPTER III

Procedures 28
Subjects 28
Collection of Data 28

CHAPTER IV

Analysis and Discussion 35

CHAPTER V

Recommedations 37
Conclusions 37

LIST OF TABLES

Table 1 Understory Stems Per Acre (Picnic) 39a
Table 2 Understory Stems Per Acre (Camprground) 39b
Table 3 Region 8 Prescirbed Burning Accomplishments 39c
Table 4 Recreation Use Figures 1983-1986 40

APPENDIX

Exhibit A - General Vicinity Map 41
Exhibit B - Turkey Fork Recreation Area 42
Exhibit C - Campground Map 43
Exhibit D - Picnic and Swimming Area Map 44
Exhibit E - Wildfire Location Map 45
Exhibit F - Prescribed Burning Plan 46
Exhibit G - Visual Quality Analysis 51
Exhibit H - Brochure - Forests Born of Fire 52
Exhibit I - Brochure - You and Forest Fires 53
Exhibit J - Brochure - About Your Smoke 54
Exhibit K - Brochure - Fire Laws and Safe Burning 55
Exhibit L - Brochure - Fire in Land Management 56
Exhibit M - Brochure - Forest Fire by Prescription 57
Exhibit N - Prescribed Burning Questionnaire and Letter 58

BIBLIOGRAPHY 61

CHAPTER I

Introduction

There are many different needs and opportunities for vegetation manipulation in planning and providing for a broad spectrum of recreation opportunities. As varied as the available experiences are so it is that there are a vast array of means to accomplish a given end.

This paper is not designed to fully analyze or make specific recommendations for even a portion of the vegetative objectives, conditions, or opportunities one might encounter. Rather an attempt will be made to evaluate and compare to some degree with other methods, one particular tool available to the recreation manager -- prescribed fire.

As Hartman (1974) makes clear, "there may still be many to which it seems paradoxical, perhaps that the traditional nemesis of the forest can also serve, under the proper conditions to be beneficial. To a public indoctrinated by Smokey Bear and the fire prevention information surrounding the long-standing and extremely successful campaign to end carelessness with fire, it is sometimes difficult to sell the idea of prescribed burning", even in our changing times.

The 1974 Forest and Rangeland Renewable Resources Planning Act (P.L. 93-378) and the 1976 National Forest Management Act (P.L. 94- 588) required that the use of prescribed fire become an integral part of Forest Service land management planning process. These along with other legislation has provided the administrative impetus for the changing attitudes toward fire on public lands.

In many parts of the country, the intentional use of fire when applied under carefully prescribed conditions has indeed gained widespread acceptance in the general forest environment as a viable management strategy. On the other hand, there is more often an unfounded reluctance on the part of some to attempt the untried. However, the challenge before us continues to be innovation and change. Recreation management involves change; a change in concept, a change in policy and a change in action. As such, fire should as easily be considered in the management scheme for recreation and visual quality benefits as it is for other resources.

Statement of the Problem

Prescribed burning has become a recognized and invaluable management tool to the forest land manager, particularly in the "piney woods" of the south. But more than that, it is a process, with fire being a part of the influence on the ecosystem and usually from whence the current forests of the nation were born.

Prescribed burning as used in this paper and defined by Mobley et al., (1973) is fire:

* applied in a skillful manner
* under exacting weather conditions
* in a definite place
* for a specific purpose
* to achieve certain results

Traditional Forest Service objectives which have been met through well planned and executed burns include wildlife habitat improvement, stimulation of available range forage, preparation of sites for planting or seeding, control of undesirable understory species,and reduction of the hazardous accumulation of fuels. Reference Table 3 in the Appendix for summary of Region 8 1986 accomplishments.

At the same time there have and continue to be a multitude of situations where fire, both prescribed and wild, have been instrumental in shaping the landscape and contributing to improving the recreation experience particularly along the more primitive end of the scale. A significant amount of research has been conducted on prescribed fire in the wildland ecosystem in the past twenty years since the passage of the Wilderness Act of 1964 (P.L. 88-577) However, when it comes to utilization in the more rural environment of the developed recreation facilities, prescribed burning has been commonly excluded and very little has been written about its benefits, effects, or opportunities for use.

In an effort to provide some general guidelines and recommendations for application of prescribed fire in and around developed facilities, the specific needs of one particular area located in the coastal plain of the southeast were examined. At the same time, additional input was obtained from other units throughout the U. S. Forest Service Southern Region. Although the emphasis will be primarily towards developed applications, some discussion and guidelines will address use for dispersed recreation needs.

Description of Study Area

Turkey Fork Recreation Area (TFRA) built in 1973 and located in southeast Mississippi, is administered by the Chickasawhay Ranger District, DeSoto National Forest. TFRA is approximately two hours from the scenic gulf coast and several large metropolitan areas. Despite the fact this area is the only developed recreation area on the district, it meets the majority of the facility based outdoor recreation needs of at least a large percentage of the local public.

Some forest visitors come from as far away as the major population centers of Jackson, New Orleans, and Mobile but the majority originate from within a fifty-mile radius which is fairly rural in nature. The result is that there is, in fact, a diverse mix of users which must be considered in making management decisions. Reference Appendix Exhibit A.

Lying amid the tall southern pines, TFRA is located on the shores of a two hundred and forty (240) acre lake which provides the focal point for recreational activities and around which there are a twenty (20) unit campground, beach, and twelve (12) unit picnic area with shelter. Water, flush toilets and showers are available in all areas, but electricity is not available. There are also boat launching facilities available with fishing and waterskiing being very popular. Excluding the lake itself, the developed facilities cover an area of approximately thirty-eight acres. Reference Appendix Exhibit B - D.

Use is moderate but has picked up in recent years as more people are discovering this relatively unknown attraction within the National Forests in Mississippi. Summary of 1986 seasonal recreation use as expressed in thousand recreation visitor days (MRVDs) is as follows:

Boating	1.2	Camping	4.2
Fishing	2.0	Picnicking	2.5
Hunting (Waterfowl)	0.5	Viewing Interpretive	1.4
Swimming	3.0	Nature Study	0.1
Waterskiing	4.0	Touring - Walking	0.2
Games - Play	0.3		

The facilities are open to use from April through the beginning of September except for the boat launch and general lake environment which remains available throughout the entire year. Although it would be desirable, from the camping perspective particularly, to keep the area open later in the fall it is not cost effective without additional funding.

Climate

Generally the climate of the area is characterized as having long, hot summers with high relative humidity, mild winters, and adequate rainfall throughout the growing season. Annual precipitation totals range between 60 and 65 inches with average summer temperatures of 90-100 degrees. According to Cross, ed. (1974), relative humidity varies but averages 75-100%. During the summer high humidities may build up progressively for several days and nights can become oppressive. Such conditions are more noticeable when wind velocity is very light or calm during the late afternoon or night. Winds occur from the southeast to southwest and averages 5-10 mph. On an annual basis calm conditions are present about one-tenth of the year.

Typically, a two- to three-week period of drought occurs in the late winter and early spring, and during this period prior to green-up and fuel moisture content increases fire danger is high. Prescribed burning season for understory treatment occurs in December and extends through the middle of March.

Topography

As is characteristic of much of the coastal plain the topography and resulting landscape is relatively flat to gently sloping with several small drains. Slopes range from 0-15% with areas in and around the campground being steeper as the ground slopes down to the lake.

Visual Resources

Much of the area appears choked with dense understory vegetation with some scattered openings. Because of the previous clearing work in portions of the campground, opportunities for viewing are generally better than in the day use area. The topographic and vegetative characteristics are such that the total landscape is predominately foreground viewing.

Vegetation

The majority of the area consists of an overstory of loblolly pine sawtimber and poletimber with some longleaf and mixed hardwood in places. Average age is 30 years. The understory, like much of the coastal plain forests, is composed of a mixture of gallberry, yaupon, greenbriar, blueberry, wax myrtle, honeysuckle, dogwood, and holly, as well as smaller amounts of other woody and herbaceous vegetation. Reference Table 1 and 2 for summary of size and number of stems per acre.

dam. Measurements of pH indicate an average of 2.0 - 4.0. Other water resources includes a perennial stream between the campground and day use area with several ephemeral streams also occurring in the area.

One of the major problems affecting the water resources has been the presence of a variety of aquatic weeds in the lake. They predominate in the cove between the two developed areas. Recommendations from zone wildlife biologist indicate that a combination of direct treatment with chemical and an indirect burning treatment should be very effective. Burning can be expected to increase the pH through volatilization of calcium and magnesium, thereby indirectly affecting weed growth.

Hypothesis

A. Climatic variables, specifically high temperature and relative humidity as well as dense vegetation patterns, which restrict air movement, significantly influences levels of non-water associated outdoor recreation activities, particularly camping resulting in relatively low use.

B. Vegetation manipulation utilizing techniques including prescribed fire can improve visual quality, air circulation patterns, and viewing opportunities resulting in overall improved recreation experience within developed facilities.

C. Periodic prescribed burning within developed facilities can reduce hazardous fuels accumulation and potential for resource loss as a result of unplanned ignition.

D. Prescribed burning has been underutilized as a recreation management tool due to a variety of reasons which could include lack of understanding of benefits and effects, lack of trained personnel, and/or fear of public reaction.

Objectives

The objectives of this paper are to:

A. Discuss opportunities for utilization of prescribed fire as a recreation and landscape management tool.

B. Develop guidelines for vegetative management at Turkey Fork Recreation Area.

C. Describe alternative treatments, estimated costs, effects of treatment and recommendations for implementation.

D. Provide practical guidelines which could be applied and adapted for utilization at other developed facilities.

E. Develop guidelines for implementing an interpretive program to explain benefits of prescribed burning plans in developed facilities.

F. Consolidate pertinent information so the interested recreation manager can have a focal point to explore further the subject at hand and have general questions answered.

G. Stimulate thought on the part of recreation planner and fire managers as to creative and innovative ways prescribed fire can meet a given management objective.

This paper is designed to explore these objectives for the following readers:

DISTRICT AND ASSISTANT RANGERS who are looking for cost efficient and more effective methods to control undesirable vegetation in developed recreation facilities.

RECREATION STAFF OFFICERS AND PLANNERS on National Forests who are interested in improving recreation opportunities for visitors particularly where climatic influences (i.e., high temperature) are overriding considerations.

LANDSCAPE ARCHITECTS who may be looking for ways to improve viewing opportunities and quality, particularly within the foreground, through increased variety and form as well as changes in vegetative texture.

FIRE STAFF OFFICERS AND PRESCRIBED FIRE MANAGERS who are interested in implementing an innovative fuels reduction program involving high risk Forest Service resources which would perhaps receive the greatest damage and loss of value if they did not receive treatment.

Assumptions

This paper is intended to present one option available to recreation managers for vegetative manipulation. It is not an attempt to insist or even intimate that prescribed burning is the only or even one of the solutions to the wide variety of vegetation problems. However, prescribed fire has application and outstanding results and benefits when implemented properly.

Specific assumptions include:

1. Some type of understory vegetative management or treatment will be needed.

2. Average summer seasonal temperatures will remain high and relatively constant over time.

3. Vegetative growth will continue to contribute to dense or otherwise coarse textured understory which reduces opportunities for pleasurable viewing.

Limitations

Although reference and some discussion has been made to traditional uses of prescribed fire in recreation management, this paper does not attempt to thoroughly evaluate all the ways that prescribed fire has or could be used as a recreation or visual resource management tool. But rather it attempts to outline and describe those conditions and situations within the more rural spectrum of recreation opportunities which lend themselves to such treatment. Primary discussions centers around USDA Forest Service Region 8 applications.

Although pre-treatment understory data was collected, constraints for completion of the project do not allow necessary time for post-treatment data to be collected and evaluated. Entrance into the "green-up" period and first growing season following treatment will be required in order to provide meaningful comparison. It is the intention of the author that this paper could be amended in order to include such specific post-treatment data and evaluation.

Similarly, public response to this type of treatment in this specific location is not known as the use season has not begun. As a minimum it would be desirable to incorporate the results of an informal survey of users particularly during the early part of the season when there may be some evident signs of treatment remaining.

However, physical and some of the sociological effects of implementing a winter prescribed burn under similar conditions have been previously studied and along with general post-treatment field observations provides the basis for preliminary conclusions and recommendations.

CHAPTER II

Literature Review

As was stated previously, one of the objectives of this study is to consolidate for recreation managers what information and data exists on the subject. Although not expecting to find a wealth of literature on the subject, the author was surprised to find a definite void of information describing any similar applications of prescribed fire.

Much has been written and analyzed concerning effects of fire on the different natural resource subsystems but without tying it directly to how these impacts could influence or benefit the entire recreational opportunity spectrum as well as human perceptions and viewing.

In order to develop appropriate guidelines and consideration for application as well as the basis for development of public awareness and interpretive programs, a review of literature pertaining to the general effects of fire on flora, fauna, soils, water, and air quality was conducted. In addition to these basic resources which would be affected, a more detailed exhaustive review was made of reported effects of fire on recreational opportunities, scenic quality, and public perceptions of prescribed fire. After each section, several considerations for management and possible application for improving recreational opportunities have been outlined.

A. Effects of Prescribed Fire in the Southeast

The southern region of the United States consists of four basic sub-regions including the Appalachian Mountains, the Piedmont, the Ozark Mountains, and the Coastal Plain. Descriptions of the general location, vegetation types both overstory and understory, as well as the general effects of fire in each of these divisions is discussed and summarized by Komarek (1982).

However, for purposes of this report, the review of the general effects will concentrate on the coastal plain region wherein the study area is located; although some references includes other geographical provinces of the southern region. More specific information pertaining to other geographical provinces of the country will have to be obtained by the reader to determine environmental limitations and constraints which might restrict application of the principles and guidelines p sented herein.

1. Effects of Prescribed Fire on Vegetation and Fuels

The general correlation between periodic fire and the development and maintenance of the southern forests and its effects on vegetation has been recognized for some time (Garren, 1939; Komarek, 1982; Langdon, 1971; and Lotti, et al., 1960).

A significant number of authors agree that the major concerns in southern pine management centers around understory control but usually only as it relates to silvicultural benefits or needs.

General effects of prescribed burning on fuels and vegetation (overstory and understory) found in the southern region as well as discussion of firing techniques are adequately discussed and summarized in Prescribed Fire Management in the Southern Region Guide. These conclusions are based on findings of numerous individual studies as well as field observations. However, several specific vegetative studies bear mentioning due to their implications when applied to the developed recreation environment.

Lotti, et al., (1960) examined the specific benefits, methods and schedule of prescribed burning treatment for loblolly pine (Pinus taeda L.) stands and discussed the varied effects on the understory that timing of the burn would produce. He concluded that winter fires will not kill many of the hardwoods in the understory as most re-sprout regardless of the frequency of burning. At the same time, the best use of a short series of summer fires is for hardwood eradication and seedbed preparation.

Impacts of fire either prescribed or wildfire can be detrimental on hardwoods and especially the thin barked species. Damage to the cambium layer is directly related to intensity, type of fire, duration of the heat source, bark thickness, stem size, season and frequency of fire. (Silker 1961).

Gallberry (Ilex glabra L.) an undesirable shrub common to the understory in the coastal plain, competes with forage species, increases the fire hazard, and thrives with frequent winter burning. However, following the initial burn the number of stems will stabilize with an average height of two to four feet (Hughes, et al., 1964).

The effects of winter burning on grass fuels and forbs is to significantly increase annual yields while causing an immediate decrease of live and dead material. (Lewis, et al., 1976).

Additional studies (Stoddard 1939) as well as observation and general experience has shown that occurrence of wildflowers along with other flowering invader species is more likely to increase following the introduction of fire which affects plant succession. Under normal successional processes many of the species which contribute to the floral beauty evident in early spring and summer could be eventually lost.

Flowering dogwood (Cornus florida L.) is also known for its ability to withstand even extreme impacts of fire and at the same time provides an eye catching and beautiful site particularly within the open park-like woodlands of the southern coastal plains. In many areas where growth is heavy and fire is excluded, other species could eventually take over and preclude a positive viewing experience.

At the same time, fire can act as a sterilizing agent against certain undesirable plant diseases (brownspot, tar spot, etc.) as well as insect attack by helping to maintain healthy stands (Cumming 1969).

Finally, there is much evidence to support the fact that in the absence of prescribed burning, fuel both live and dead, can build up on the forest floor up to two tons per year. This is particularly true for pine forests but to a lesser degree in hardwood stands. When left to accumulate, there are many cases where these fuels as well as those which result from maintenance and other arboreal activities, are very flammable and can present a fire hazard. (Davis, et al., 1963 and Byram, et al. 1952).

Considerations for Management and Applications:

1. A thorough knowledge of the forest types and understory components in an area which is being considered for treatment is a basic prerequisite to implementation.

2. Scheduling of prescribed burns in a developed recreation environment would normally be planned for the off-season and as such the results of a cool winter burn would be more likely to meet the objectives as it affects vegetation and particularly the hardwood component.

3. Consideration of the type of prescribed burn (i.e. backing, head, flank) should be given serious attention in planning as this could be the most significant factor affecting obtainment of desired objectives. Backing and flanking fires should generally give the best results for burns involving recreation and visual quality resources.

4. The use of prescribed fire could be utilized to increase and encourage the occurence of certain flowering and visually pleasing vegetation thus improving recreational opportunities for general nature lovers, wildflower enthusiasts, garden club members, and even the "Sunday driver". Application within the developed spectrum could also contribute to opportunities for interpretation and would be particularly beneficial where opportunities for family enjoyment and learning would occur. Use along interpretive trails and guided auto tours would appear extremely beneficial.

5. Prescribed burning in and around developed recreation areas where hardwoods predominate or are the desired replacement trees, is questionable at best. However, there may be applications where adequate protection can be provided, intensity is low, or where thicker barked species occur.

6. Protect ornamental shrubs and trees which may occur within the area during burning operations. Practical experience indicates there are two options; either raking around individual plants which one does not want to be impacted and/or wet down the ground around them utilizing backpack pumps or slip-on vehicle pumper during firing operations.

7. Fire can be very instrumental in removing natural accumulations as well as eliminate or at least reduce quantities of "activity fuels" and slash left after some tree removal and maintenance operations (i.e., hazard tree removal, insect infestations or perhaps even commercial thinning or selection harvesting activities in developed areas.

2. Effects of Prescribed Fire on Soils

The environmental impact of prescribed fire on soil as reported in available literature is variable. Generally effects can be divided into physical and chemical but in either case, depend largely upon the type of fuels, fire intensity, nature of the litter layer and soil properties including moisture content, texture and percentage of organic matter.

According to Wells, et al., (1979), all soil properties that are affected by fire relate to the relative amount and duration of exposure to heat. Prescribed fires are generally low intensity events and as such should not be expected to have significant adverse impacts on soil properties or long-term site productivity except perhaps when dealing with fragile soils.

Wells (1971) reported on a significant long-term study conducted on the Frances Marion National Forest in South Carolina made on typical coastal plain pine forest.

> "Prescribed burning of mature southern pine stands normally leaves some of the forest floor, even when annual burns are applied. Generally prescribed burning in these stands causes small increases in soil pH, organic matter, nitrogen, phosphorous and exchangeable calcium and magnesium in the surface two to four inches of the mineral soil. The effects of burning on the change of mineral element status in the soil is related to the amount and content of those elements in the burned organic matter."

Chemical

Reports on the effects on nutrient cycling are mixed. However, according to Pritchett (1976), and Stone (1971), prescribed burning rapidly releases nutrients and as a result there is loss by volatilization with only a small portion of the soluble minerals possibly leaching deep into the profile before utilization. Pritchett states that "controlled burning releases small but significant amounts of phosphorous, calcium, and magnesium in the ash deposited on the burned surface. These small additions alter the properties of the surface layer of mineral soil only slightly."

At the same time, despite the obvious loss of organic matter and resultant nitrogen decrease through volatilization following prescribed burns, Pritchett (1976) summarizes the conclusions of previous research which examined long term impacts and states there is no overall decrease within the system.

Physical

Humphreys, et al., (1981) have summarized from research conducted that "it is apparent that few fires within the low intensity range (as in prescribed burning) would be hot enough to effect soil structure."

Additionally Wells, et al., (1979) supports this conclusion with the following statement:

> ".... indicates that fires were not intense enough to produce direct effects upon the structure of soils, except where complete removal of the duff and litter and subsequent exposure of mineral soil results in a puddling and baking of the surface."

According to a study done by Wright, et al., (1982) in central Texas, most erosion and adverse impacts on forest soils occurred on steep slopes (30-60%) which were not seeded properly. It is also the case that most "bad press" concerning erosion associated with prescribed burning activities results from improperly constructed and maintained firelines rather than from the burned area itself.

In conclusion, as with vegetative effects, reference the Prescribed Fire Management in the Southern Region Guide which provides an excellent summary of general effects on soil temperature, microflora and fauna in addition to these more specific studies discussed above.

Considerations for Management and Application:

1. Plan and execute prescribed burns after considering soil properties and characteristics. Exclude fire from sensitive areas where resource damage might occur.

2. Keep construction of fireline needed for control and thus impacts on soil resources to an absolute minimum. When possible utlize natural barriers for control lines -- including roads, trails, streams, and hardened recreation sites.

3. Any constructed firelines particularly when steep slopes are involved, should be restored and seeded in order to prevent soil erosion or damage. Water bars should be installed as needed. Consider utilizing a seed mix desirable for wildlife thus increasing potential for use and resultant opportunity for observation of wildlife by the forest visitor and recreationist.

3. Effects of Prescribed Fire on Water

The hydrologic impacts of prescribed fire has received limited study. However all research reviewed as it involves effects on the water resources, indicates that there is little if any risk from prescribed fire when implemented according to prescription.

As Komarek (1982) states " watersheds are one of the most important natural resources throughout the southern region, and the effect of prescribed burning on water yields is of considerable importance". No where would this be more the case in the south than in the appalachian mountains where extensive watersheds occur. However, in large portions of the piedmont and more so in the coastal plain where there are smaller watersheds and flatter terrain, adverse impacts from burning are not likely to occur if at all.

According to a review conducted by VanLear, et al.,(1983), a study done by Brender and Cooper (1968) reported that repeated prescribed fires had little effect on hydrologic properties of piedmont soils in Georgia. Cushwa, et al., (1971) noted no increase in erosion in established gullies after a single burn in the South Carolina piedmont.

In addition, results of a study conducted by Richter, et al., (1982) in the coastal plain of South Carolina indicated that "periodic prescribed fires in southeastern coastal plain pine forests are not likely to have appreciable effects on the quality of ground and stream waters. Considering the utility of prescribed fire in the multi-resource management of these forests, it is doubtful that alternative practices could accomplish these objectives with such environmental costs."

Another study conducted by Douglas, et al., (1983) in the piedmont of South Carolina indicated that annual prescribed burns do not significantly affect storm runoff, sediment concentration, or sediment export from the watersheds. Both runoff and sediment export increased from one watershed, but was the result of causes other than prescribed burning. Analysis showed no significant changes in NO3-N, NH4-N, Ca, Mg, or K concentrations or export after burning. Sodium concentrations before burning was significantly different for burned-unburned watershed pairs but was attributable to other factors.

Considerations for Management and Application:

1. Avoid intense fires resulting in complete removal of vegetation, litter and organic matter. This can also contribute to the problem of reduced large pore spaces and as a result poorer infiltration, thus increasing overland flow. This can be particularly true in fine textured silt and clay soils.

2. Avoid removing shading vegetation from along stream courses and lake shores which could result in negative effects not only on the water resource itself but the fisheries and ultimately the recreational experience.

4. Effects of Prescribed Fire on Air Quality

One of the primary concerns of prescribed burning as it interest much of today's more environment conscious public, is the issue of smoke management and air quality. According to Paulson, et al.,(1980) and Hall (1972), "clean air" is often thought of as a reality that once existed but which can be returned to a pristine condition if proper steps are taken.

On the other hand, the atmosphere has been so altered by various activities that this is a false reality that many are searching for. At the same time, the Clean Air Act of 1970 as well as subsequent ammendments are all designed to improve or at least limit the atmospheric concentrations of emissions.

Many studies and papers have been written about the nature of emissions from prescribed burning and problems associated with improper planning which can result in poor dispersal, reduced visibility as well as more general impacts with regard to types and quantity of emissions which could result under different conditions.

However, at least one of these bears specific mention. Sandberg, et al., (1981) found a correlation between fuel types, amount of emissions produced, and as a result the type of fire which could be expected to reduce impacts on air quality. "Low intensity and smoldering fires are the least efficient. Backing fires are considerably more efficient than heading fires because a smaller proportion of the available fuel is consumed in the inefficient smoldering stage and because fuels are preheated more slowly."

As a result it is the obligation of the professional land manager to apply such knowledge when utilizing prescribed fire for any given purpose.

Considerations for Management and Application:

1. Application for prescribed fire for recreation mangement could necessitate that even more attention be given to ways of minimizing visible air "pollution". This would be the case not only along the more developed recreation opportunity spectrum where higher percentage of forest visitors could be present in the vicinity at the time of application, but also in the more remote primitive environment where the user undoubtedly desires a truely pristine and unblemished environment.

2. Develop programs and seize opportunities to educate the forest user and recreationist about what smoke "pollution" is or isn't, remembering that emissions from prescribed burning are seasonal, temporary, and of short duration generally resulting in minimal adverse impacts on the air quality.

3. Special care and planning should be given in areas where high recreation use and vehicle traffic volumes coincide with prescribed burning season. No where would this be more the case than in portions of Florida which receive very high levels of use

from people "coming south for the winter". At the same time, the majority of prescribed burning applications occur within the same time frame.

4. Although not directly related to the issue of air quality, another concern which is generated, is one of visitor safety. Attempting to implement a prescribed burn in areas of high concentrated use would not appear to be wise. Special consideration and attention would be needed to minimize risk.

5. Effects of Prescribed Fire on Fauna

The most significant effects on fauna are the result of changes in the environment and habitat structure with resulting differences in food and cover being the greatest and immediate change as opposed to direct mortality during a prescribed fire.

Prescribed fire creates a mosaic of vegetation types which provides for habitat diversity due to the fact that fires rarely burn evenly (Heinselmann 1973 and Cooper 1961b). This habitat diversity is often translated into diversity in animal populations which inhabit a given area.

Lyon, et al., (1978) as well as the Prescribed Fire Management in the Southern Region Guide does a good job of summarizing both direct and indirect effects on both vertibrates and invertibrates as well as examining some of the more significant studies on the subject.

Although some consider fire very destructive of wildlife (Ahlgren and Alhgren 1960, Lutz 1956), most of these conclusions are based on impacts which are the result of intense wildfires as opposed to cooler prescribed burns.

As Lyon, et al., (1978) points out, even under prescribed burning conditions there is much evidence to suggest that although some vertibrate mortality has been reported, the most common opinion is that vertibrates are rarely killed in prescribed fires and where death does occur it is usually neglible (Vogl 1967, Phillips 1965, Stoddard 1963).

General conclusions of many studies summarized by Lyons, et al., (1978) indicate that:

a. Larger animals usually move calmly from the fire.
b. Smaller rodents are most likely to exhibit panic and are more likely to suffer death due to suffication as a result of going into burrows or holes un the ground.
c. Most birds show no fear of fire and some are attracted to it.
d. Alligators will use burned shoreline almost exclusively.

With regard to soil fauna, burning is believed to limit the numbers of ticks and chiggers as well as other insects because those unattached host animals are vulnerable to fire and few can escape (Stoddard 1935).

Similar studies in loblolly pine stands in South Carolina, found that the populations of soil fauna were reduced by annual and periodic prescribed burning, with periodic burns spaced up to five years apart allowing populations to return to normal within three or four years (Metz and Farrier 1973). Studies which found that insect populations increased following fire, were generally in areas where trees were injured, weakened, or suffer mortality. At the same time, despite the host condition, there are in fact some insects which are generally attracted to smoke and heat (Evans 1971). However, as the result of cases of increased insect populations in certain locations, the invasion of various species of birds including woodpeckers would also be expected to occur.

Considerations for Management and Application:

1. Although negative effects on the recreation experience could result from even short-term insect population increases following the occurrence of fire in some locations, the likelihood is not high. The common belief on the part of the mountaineer as well as the flatlander that burning of the woods in the spring of the year to get rid of "chiggers, ticks, and other such vermin" perhaps has merit when applied to improve certain recreation experiences (i.e., camping, picnicking, hiking, etc.).

2. Changes is wildlife habitat as a result of prescribed burning can occur throughout the range of environments contained within the recreation opportunity spectrum. Opportunities for viewing, photography, and hunting of wildlife could be expected.

3. Where alligator populations may be present or are more likely to occur in the proximity to developed recreation areas (i.e. Florida and other parts of the deep south) be aware of how prescribed burning could affect future behavior with regard to use of these areas.

B. Effects of Prescribed Fire on Visual Resources

The historical role of fire both prescribed and wildfire in shaping the very nature and character of the forest landscape is undeniable and well established. At the same time, the aesthetic value of our natural resources has long been recognized but with even more importance placed on scenic quality with the upsurge of the environmental movement during the past fifteen to twenty years.

As Omni and Laven (1982) point out there is little published information on fire's impacts on visual perceptions, even though methods do exist for assessing individual preferences for natural and manipulated landscapes. Several authors including Daniel and Boster (1976), Simpson, et al., (1976), Gardner and Melhorn (1979), and Daniel, et al., (1979) indicate that schemes exist for assessing user preferences for various scenic settings, perceived management practices, and amenity resources.

Many consider prescribed burning to be the ultimate landscape management tool capable of producing a wide range of positive long-term effects on the visual elements of form, line, color, and texture (Orr 1976, Meskimen 1971).

Komarek (1982) outlined four results of prescribed burning which could produce potentially negative perceptions particularly on the part of an uneducated public and includes:

* blackened ground
* soot on the trees
* scorched needles
* fireline construction

He along with other studies (Anderson, et al., 19___) as would seasoned practitioners concluded that each one of these affects is short-lived when prescribed burning is applied properly.

As discussed under effects on vegetation, there are several studies which identified opportunities to enhance the visual resources and as a result in many cases the recreation experience, by simply promoting the amount and opportunities to view flowering trees, shrubs, and wildflowers.

Similarly practical experience and common sense indicate that establishing vistas and other opportunities for viewing certainly enhances the visual quality. On the other hand, prescribed fire can alter plant succession or severely suppressed growth and as a result over time can remove visual variety, Bacon (1985). A balance should be maintained between managing for a nonproductive "visual wilderness" without any treatment and the geometric monoculture (Meskimen 1971).

Considerations for Management and Application

1. Consider time of the year and proximity to use period when applying to developed recreation facilities. Allowance should be given for adequate green-up period.

2. Alleviate criticism concerning impacts of bole scorch and minimize char heights on hardwood stems through well planned execution with the direction of the burn away from the primary viewing corridor.

3. Plan "cool winter" fires which limit potential for causing needle and crown scorch.

4. Minimize amount of fireline to be constructed by utilizing natural barriers. Avoid utilizing a trench plow in more visually sensitive areas (i.e., developed recreation areas) but rather create smooth pushed line which can be easily rehabilititated and seeded.

5. Carefully plan, develop and utilize prescribed fire in different environments to create visual variety by arranging vegetation types so edges from naturalistic patterns occur. Spot burning techniques as opposed to the effects from a general head or even a backing fire, work well to create such variety within the developed recreation environment

6. Consider utilizing fire to create visual quality along trails, auto tours, or other areas where viewing could be high.

7. Implement burning programs on national forests in accordance with established satndards and guidelines outlined in forest land management plans for areas of retention and partial retention visual quality objectives. Such practices could include utilizing only late winter burns, requesting landscape architect assistance, and prepare a visual quality analysis as well as other practical criteria for implementation as outlined in theis report.

C. Effects of Prescribed Fire on Recreation

As discussed during the problem definition stage in the early part of the paper, there are numerous studies which discuss philosophy and opportunities, and guidelines have been identified, when considering utilization of prescribed fires in enhancing the primitive wilderness recreation experience (Fischer 1984, Heinselman 1973, Kilgore 1974). Most of these cases

described occur within the state or national (United States and Canadian) parks (Dube' 1982, Gaidula 1983, Heindrickson 1972, Lathrop and Martin 1982). It was not until February 1985 that the Forest Service adopted a policy allowing planned ignitions in wilderness areas (Huck 1985).

At the same time, since 1978 and even earlier in some areas including the Everglade, Sequoia-Kings Canyon, Yellowstone and Grand Teton National Parks as well as the Selway Bitterroot Wilderness area, prescribed fires originating from unplanned ignitions, (mainly lightening), have been permitted to play a more natural role in the ecology of designated wilderness areas.

Many have debated over the years about the philosophical merits of planned versus unplanned ignitions as well as general wilderness wildfire suppression policies (Kilgore 1983, Jones 1974). Suffice it to say that in the primitive undeveloped end of the recreation opportunity spectrum, prescribed fire perhaps is the only tool available to effectively maintain not only the natural and quite often rare and unique ecological vegetative conditions within the areas but at the same time, enhance and sustain opportunities for an enjoyable "wilderness experience"

Other benefits within wilderness recreation management as is evident with the Bradwell Bay Wilderness on the Appalachicola National Forest in Florida, involve fire hazard reduction. There are areas such as this, where because of the heavy fuels accumulation or other vegetative conditions, planned ignitions are virtually a necessity. Without fire prescribed or otherwise, the very wilderness itself as well as the adjacent lands, could become a wasteland as a result of destruction by wildfire (Towle 1983). This would be particularly true in the coastal plain of the deep south.

On a more practical level, Mutch and Davis (1983) discuss considerations which must be given to visitor protection and safety when applying prescribed fire to the wilderness environment. They outline recommended guidelines with regard to public awareness and education as well as similar needs for agency professionals responsible for the complex job of recreation, wilderness, and fire management.

Although some authors (Komarek 1982, and Perkins 1971) mention indirect benefits for both general forest aesthetics as it involves the recreation experience itself, there was only one study found which extolled the benefits of prescribed burning in the developed context. Cumming (1969), described pioneer efforts undertaken on the part of the New Jersey Department of Conservation which utilized prescribed burning within the

confines of the developed campgrounds, picnic areas, and other roadside and recreational areas. Although dealing with different species, general vegetation conditions and fuels accumulation problems are not unlike those of the southern coastal plains. Many of their parks are located in the less urban portions of the South Jersey pine barrens. Discussion included a summary of guidelines and recommendations, some of which would appear to apply universally.

Relative to other parts of the country, prescribed burning in the coastal plain of the south within some of the developed recreation areas has been fairly regular over the past ten years but widespread utilization has been limited at best. Much experience has been gained as to methods, techniques, and opportunities. Reference Chapter III for summary of Region 8 survey results.

On the other hand, Cannaughton (1972), discussed impacts of fire on forest values and services including recreation. Although primarily referring to wildfire, without improved public education, an audience unaware could easily perceive all impacts of fire on recreation as bad. He states, "the impact of fire on on-site recreation use is grave and serious. Have you ever visited a campground recently burned over? If you have there is little explanation of devastation that is needed. The impact is dramatic, severe, and discouraging. With the best in rehabilitation efforts recreation opportunities have been downgraded. Fire and normal public use aspects of the forest just do not go together." He does go on to briefly point out that fire properly managed can have some positive values.

At the same time as it relates to dispersed recreation opportunities, Cannaughton and Kautz both discuss benefits to berry pickers (huckleberries, blueberries, etc.) as a result of past wildfire activities. Indications are that in areas healed from fires of years past this activity is no longer possible. Perhaps in many cases we are missing out on an opportunity to improve the environment for such recreational activities. Much is dependent upon management objectives and other factors or needs may become secondary.

Perkins (1971) does a good job of summarizing more of the benefits of prescribed fire within the semi-primitive motorized and non-motorized portion of the recreation spectrum. Benefits could include:

a. improved hunter access and opportunities for hunting as a result of improved wildlife habitat diversity

b. creating opportunities for birdwatching as it relates to improved habitat particularly for certain species dependent on fire to maintain their habitat (i.e. Kirkland Warbler).

c. improved general viewing opportunities

d. photography opportunities can be enhanced by increasing visual quality and variety

e. utilization of prescribed burning for trail maintenance and ultimately to improve the hiking experience. Experience along portions of the Appalachian Trail in North Carolina, Tennessee, and Virginia has shown that fire is particularly effective at knocking back encroaching shrubs, briars, and other vegetation in old fields and balds (both grass and heath). It can help to improve and maintain some of the most scenic vistas in the appalachian mountains.

Considerations for Management and Application:

1. Evaluate biological and ecological factors when considering the use of prescribed or controlled fire in developing land and resource management objectives for recreation planning.

2. Utilize established guidelines (Fischer 1984) in fire management planning for wilderness, and other wild, natural or undeveloped areas.

3. As a result of ever increasing recreational use of wildlands, develop education and awareness programs to help ensure public safety when utilizing prescribed fire in this primitive environment.

4. Develop guidelines for specific application to recreation management and incorporate them into regional prescribed fire management guides.

5. Consider and encourage utilization within the developed spectrum and apply prescribed fire when this the most effective method.

D. Alternatives to Prescribed Fire

Komarek (1982) once again does an excellent job of summarizing not only alternatives to prescribed burning but also the effects of each when attempting to control understory vegetation:

* mechanical (chipping, bush-hogging, and drum chopping)
* chemical
* hand labor
* grazing

He indicates that these alternatives are an "attempt to find substitutes for a natural force". Based on a thorough literature review, he concludes that environmental impacts and high costs of these substitute methods are less environmentally acceptable and generally less effective.

Use of any mechanized treatment except in widely spaced stands runs the risk of physical damage to standing timber as well as impacts on the soil and water resources.

Balmer (1976), indicates that herbicides do offer a practical alternative to the use of fire and can include aerial application, mist blowing, or individual stem injection. However, he does point out several limitations including use around lakes and streams. Consideration must also be given to number of stems per acre and size of stems which can be limiting factors to injection. Mist blowing can be effective on stems too large for prescribed burning but drift and species selectivity can be a problem. Komarek (1982) also states that at present there is no known chemical treatment that will eliminate fuel and fire hazard over large areas.

With regard to hand applications for understory manipulation there appears to be a place for such within small limited areas including developed recreation areas. However, Komarek makes the point that more than likely the material cut would have to be disposed of either by burning of piles, chipping, or hauling it off and as such would undoubtedly require larger labor forces such as SCSEP, Job Corp and YCC. As a result the cost of such an operation would be high.

He does conclude that in some forestry practices specifically site preparation following timber harvesting that these alternatives may be better utilized than the use of prescribed fire.

Considerations for Management and Application:

1. Evaluate individual site conditions, desired objectives, and available resources to determine method(s) of treatment which are most effective both in terms of costs and environemntal impacts.

2. Where labor resources are relatively high and one can not afford some of the short-term negative effects of prescribed burning, consider these alternative treatments.

3. Consider utilizing a combination of treatment methods.

4. When dealing with more dispersed forms of recreation and large expanses, prescirbed fire may be the only efficient method of vegetative manipulation available.

E. Public Perceptions, Education, and Prescribed Fire

Despite changes in fire management and control policies over the past twenty years, public perception, acceptance and attitude toward prescribed fire is one aspect of the fire management program which has received minimal attention.

As Taylor, et al., (1984) points out relatively little research has directly assessed public perceptions of fire and fire effects. He summarizes several studies including one by Stankey (1976) in which wilderness user's knowledge and attitudes were tested and found that the more knowledgeable and educated individuals were the more willing they were to accept prescribed fire in the wilderness environment. His findings suggested that while a majority of users favor suppression, a substantial minority support a more natural role for fire. Few found either total suppression or no suppression at all acceptable.

Similarly, education appeared to be a limiting factor in a study conducted by Rauw (1980) where he reported on responses of usersto a survey designed to rate different types and severity of fires as to acceptability for various kinds of recreation in Arizona. The effectiveness of information brochures in increasing fire knowledge and tolerance was also tested. He found that "recreational acceptability differs substantially by recreation activity, with camping and picnicking being especially sensitive to fire effects." However, he indicated that prescribed burning may be more generally accepted than forest managers sometimes expect. Respondents in this survey, whether informed of fire effects or not, selected 'forest managers should periodically burn underbrush and debris in pine forests' over 90 percent of the time. At the same time, he concluded that "educational brochures can increase the public's knowledge of fire effects and tolerance of fire use in forest management" but it may not change their perceptions in terms of scenic quality or acceptability for recreation use.

When examining the subject of public perception of prescribed fire, there appear to be several areas of confusion (Tikkala 1976):

* fire by prescription versus wildfire; "good" versus "bad"

* emphasis on fire prevention for so long

* regional differences (ie., coastal plain versus bottomland or mountain hardwoods)

At the same time, Montgomery (1976) indicated that perhaps we as professionals give far too little credit to the public for their understanding of the differences in types of fires. He based this upon the findings of a 1976 survey conducted for the Advertising Council to determine public awareness of fire prevention and to measure their attitudes about forest fires. They found that across the nation, 70 % were aware of the fact that fire is used as a tool for forest management. Only 7.3 % are against fires being started for any reason and "two-thirds of the public believe prescribed fire should be used whenever foresters judgement determines it is necessary".

On the other hand, attitudes toward fire, like attitudes on any subject, varies widely between people and groups of people. There is some evidence to suggest that additional education of the public about the benefits and effects of prescribed fire is needed (Hall, 1972 and Stankey 1976). Attempts to clarify and explain those areas of concern raised by Tikkala (1976) would undoubtedly by beneficial. It is the recommendation of Perkins (1976) that in order to acomplish such a task, every advantage should be taken of the latest techniques in the field of mass communication and perhaps efforts expanded to the degree that Smokey Bear and fire prevention programs have been promoted.

In conclusion, "as in any form of communication, personal contact is the most important asset any agency or group has in presenting ideas to the public. A fire also makes a great media happening, and offers an excellent opportunity to develop media contacts which could do yeoman's service for the information program" (Bethea 1976).

Considerations for Management and Application:

As a part of the process for implementation and management of prescribed fire in recreation management:

1. Formulate plans to educate and involve the public.

2. Develop communication programs directed toward different audiences.

3. Consider gradual changes in prescribed fire policy in areas where no previous treatments have occurred or in areas where such is not a standard practice.

4. Develop or utilize existing brochures, posters or audio-visual aids which describe benefits of prescribed fire for public education programs within the developed areas themselves, in local communities, and/or in personal contacts. Reference Appendix Exhibits H-L.

Procedures

General procedures for data collection designed to provide a basis for vegetative management within the study area, as well as application to other recreation opportunities, included a combination of methods and resources.

Development of general guidelines and recommendations not only necessitated obtaining information from literature reviews and results of unpublished applications in other locations but also collecting specific site data. Methods of collection as well as presentation of data will be the subject of this chapter.

Subjects

As it relates to the specific study area, current vegetative conditions, general site characteristics, impacts from past treatment, and current recreation use levels became the focus of the paper in light of defined objectives and previously developed hypothesis. The search was also expanded to include to a limited and less detailed degree other districts within the southern region as well.

Collection of the Data

A. Applications

To gather information on previous and ongoing applications in other locations, a letter was developed which stated the objectives of this paper. The letter along with a questionnaire which asked some basic questions regarding prescribed burning utilization was then sent to each national forest supervisor within Region 8 with a request to distribute such to each individual ranger district for comments and feedback. Several out of region contacts were also made utilizing the same method.

Of the 103 districts in Region 8, 82 responded for a rate of 80%. Questions and summary of survey responses are as follows:

Question 1. - Has prescribed burning been used as a visual or recreation management tool on your district? How often has it been used?

Approximately 53% responded affirmatively. Responses were categorized as follows with some districts having more than one type of use:

Type	No
a. developed recreation area	28
b. debris along lake shore	2
c. dam maintenance	2
d. bald maintenance	7
e. dispersed recreation (hunting, hiking, and wilderness)	8
f. visual quality	7
g. wildlife viewing	1

Several indicated a "no" response but then went on to discuss other types of burning which was implemented and benefited general visual quality. This was more common in responses from coastal plain districts. In this case, the response was tabulated as a "yes" under the visual quality category.

Frequency of prescribed burning when applied in developed areas varied from a single application once in ten to fifteen years to every two or three with an average of three, depending on specific vegetative conditions.

Question 2. - Describe objectives and goals of the project(s).

Responses can be categorized as follows. Once again more than one objective was often indicated but only those specifically mentioned were listed.

Objective	No.
a. fuels reduction and reduce fire hazard	20
b. improve visual quality and viewing by removing dense undergrowth or unwanted vegetation	25
c. reduce need for raking leaves	1
d. species composition	1
e. remove woody stems for purposes of dam maintenance	2
f. safety - remove hazardous material from lake during low water periods	1
g. trail maintenance	2
h. maintain balds and vistas	7
i. enhance viewing of flowering shrubs and trees	5
j. increase air circulation	3

k. reduce real or imagined threat of snakes and critters to campers and little children	1
l. improve access to lakeshore	1
m. clear up impacts from natural disaster	1
n. fertilization	3

Question 3. - What are the environmental conditions when utilized (vegetation, topography, weather, etc.)?

Vegetation - Responses varied depending on the objectives and included:

a. Developed recreation areas
   -- typical southern pine forest types with moderate to heavy understory 3-15 feet in height
   -- fuels accumulations 3-5 years; avoid heavy build-up and heavy needle drape
   -- there were two cases of burning leaf litter in hardwood stands within the developed recreation area

b. Balds
   -- briars, grass, laurel and a variety of other woody and herbaceous materials
   -- in one case it was reported that the fire was ineffective in controlling this type of vegetation

c. Dams
   -- encroaching woody sprouts and grass cover

d. Lakeshores
   -- heavy coarse fuels composed of large logs and branches
   -- some accumulations of leaf litter

Weather - the controlling factors were:

fuel moisture - most respondents indicated moderate fuel moisture was desirable and in the case of bald maintenance, one suggestion was that treatment be initiated several days after a light snowfall when snowmelt had occurred so as to avoid or minimize fireline construction.

temperature - respondents indicated that temperature was cool; 40-60 degrees was the average range.

winds - light winds; 2-5 mph was average.

Other considerations included:

a. type of fire which was usually backing or spot burning
b. time of the year was always in the winter

Question 4 - Describe any problems encountered.

Of the respodents who had actually utilized prescribed fire in the recreation management scheme, 36% indicated absolutely no problems were encountered. An additional 50% indicated no major problems but some of the routine concerns which had to be handled included the following:

-- state restrictions and burning laws
-- establishment of control lines with limited labor
-- smoke management
-- needle scorch, charred bark
-- weather considerations and changes in fire behavior
-- users (particularly children) getting smut on them
-- protection of flowering bushes, ornamentals, and hardwoods
-- some need for other type treatments in the case of balds
-- damaged blazes on trails
-- changes in fuels arrangement and amount
-- protection of improvements (ie., tables, lantern posts and toilet buildings)
-- cost; recreation function can't afford to cover
-- fire too hot resulting in unacceptable damage; increase in stress and insect activity if this is the case
-- fire scars on hardwoods
-- users in the area to be notified and use limited if not completely curtailed particularly in the developed environment

Question 5. - Describe public reactions or feedback received.

Approximately 76% indicated no negative public reaction was received. Of those who had not utilized prescribed burning 2% indicated part of the reason was because of perceived public reaction. It should be pointed out that these results do not reflect to what degree individual units solicited feedback from the public.

Comments received included:

-- very favorable comments about how pretty and green everything appeared within a month of treatment
-- liked open park-like appearance
-- comments about improved access for hunting
-- appreciated additional opportunities for viewing

-- most users accept burning as a part of their "southern culture"; people from other parts of the country on at least one occasion expressed concern about the burning in a developed facility
-- many welcomed "control of snakes and ticks"
-- positive comments from state wildlife biologists
-- some negative feedback from visual effects
-- reason for any negative feedback was primarily due to lack of understanding
-- initial criticism from some who thought redbuds and dogwood had been killed
-- negative comments from within the organization; "doubting Thomas"
-- good success in educating the public through news media and public meetings
-- improved safety to allow for "seeing what is out there in the woods"
-- some users in the general vicinity complained about smoke at the time of implementation
-- public noticed and approved of improved air circulation
-- reduced insect breeding grounds
-- regular visitors expressed approval
-- liked being able to see wildflowers and flowering shrubs

Question 6. - Provide brief description of effectiveness.

Approximately 98% found burning to be moderately to highly effective as a tool for vegetative manipulation. In the case of bald maintenance, respondents indicated less than desirable effectiveness with just burning and recommended a combination of treatments to fully meet objectives.

Several respondents commented that prescribed fire has proven itself to be the most practical tool for fuels reduction and understory control in both the developed recreation environment as well as the general forest environment when attempting to meet established visual quality and improved experience objectives.

Question 7. - Other comments.

A variety of responses did not fall into any of the other categories and included:

-- need to utilize experienced, qualified personnel
-- need for additional research and study
-- involve landscape architect in planning and implementation process

-- ensure key hardwoods and ornamentals are protected; recommended water ring and or raking around trees, shrubs or structure to protect
-- need proper funding levels to get the job done

B. Vegetation

Specific site pre-treatment data was collected during December and January 1986-1987. The primary interest involved the vegetation both understory and overstory. Thirty-two random plots within the two developed portions of the study area were inventoried. Individual plots were one-hundredth (1/100) acre in size and were located utilizing random predetermined distance and azimuth from each hardened site.

All herbaceous and woody stems greater than one and up to thirty feet in height were tallied into six diameter classes by genus and/or species. A separate inventory was conducted to determine basal area, average diameter and height estimations for all pine and hardwood sawtimber and poletimber. Reference Table 1 and 2 for summary of inventory.

Although it was the intention of the author to include such in the final version of this report, similar post-treatment data was not collected because adequate time had not transpired to determine understory mortality. However, general ocular estimations following implementation were made which should provide an adequate basis for tentative recommendations and conclusions relating to this particular site.

Slides (Kodachrome 64-35mm) were made at each point and should provide for a visual record and perhaps a more objective baseline from which to estimate treatment effectiveness and visual quality. Five permanent camera points eacn were established in both the day use and campground.

C. General

Other general site characteristics were obtained during field review. The results of a study conducted by D.J. Ebert in 1978 of the Turkey Fork Reservoir also helped to provide a basis for the description of the current hydrological environment within the study area. No additional site data was measured and reliance was placed upon information contained within a silvicultural examination and prescription report for compartment 463, prepared by Lew W. Percell 08/12/81 and included soils, wildlife, and some timber stand measurements.

D. Prescribed Burning

During the inventory stage prior to implementation, a burning plan was prepared in accordance with FSM 5142. Reference Appendix Exhibit F. Input was obtained from staff specialists including landscape architect, recreation and fire staff including both technical and professional experts. A visual quality analysis was also prepared as part of this process. Reference Appendix Exhibit G.

Weather information at the time of implementation was obtained utilizing the instruments in the standard fire belt weather kit. Parameters measured are shown on page 48 in the Prescribed Burning Plan. No highly instrumented fire data was calculated. Implementation was according to plan.

E. Other Treatment

Although not widespread in nature, utilization of several different methods of understory treatment were undertaken, within the study area described previously in this report, during the period 1982-1985. Portions of the campground understory were removed utilizing hand labor with brush axes and chipping. Three different treatments were applied during that period of time with cost varying from $300 to $650 per acre. In contrast, treatment for prescribed burning cost approximately $10 per acre with more area treated.

Previous treatment information was obtained from Harvey Moody, forestry technician on the Chickasawhay Ranger District, DeSoto National Forest. Costs were calculated based on this information.

F. Visitor

Visitor data was collected during the 1981-1986 recreation season utilizing traffic counters located at the entrance to each area. Individual fee envelopes as well as personal observation were utilized to make appropriate adjustments to counter figures. Level of accuracy varies. Reference Table 4 for explanation of figures.

CHAPTER IV

Analysis and Discussion

Four year pre-treatment visitor use data shown in Table 4 should provide a baseline from which comparisons can be made in future years. This information should help determine if such treatment can in fact help improve the recreation experience and thus increase the use levels in areas where climatic variables are major considerations and perhaps limitations to recreation participation and activity.

Conclusions, on the part of practitioners responding to the regional survey conducted, indicated that applications in these other locations contributed significantly to an improved recreation experience. Such conclusions were often the result of direct public feedback about "how nice the area looked" thus complementing the clean, often park-like and open appearances of the areas treated.

While prescribed burning could contribute to improved experience and use levels in the long-term, short-term reductions could occur because of alterations in immediate visual quality. Because of the time constraints it was not possible to conduct a visitor survey to determine public perceptions and ratings of treatment relative to acceptability of the setting for certain recreation uses or expected experience levels. However, based on general feedback obtained from the users of the area during the first season after treatment all comments were favorable as to how the area "had been improved".

Once again regional survey results indicate that in similar areas treated the majority of recreation managers did not receive any negative feedback. At the same time, it must be recognized that this does not mean that all forest visitors are accepting of such practices; they just may not be prone to be highly vocal or may choose to go elsewhere. However, except for those incapable of written communication, most users do in fact, have the opportunity to make comments and suggestions on their individual fee envelopes in most developed areas receiving treatment.

Different parts of the areas were burned on three separate days between February 3-12, 1987. Areas burned first already exhibit much of the vivid green flush of new growth not only associated with the introduction of a new growing season each spring but which is one of the benefits of basic chemical properties and reactions of the soil.

It is apparent from preliminary observation at this early stage following treatment, that although visual impacts are evident (i.e., some scorch, deadened vegetation, and blackened ground), prescribed fire is effective in reducing fuels accumulation, dense undergrowth, and opening up viewing opportunities. Approximately 40% of the understory was consumed and total fuels were estimated to be reduced by at least 50%.

Total stems per acre and average height of understory vegetation within the day use area as compared to the campground is indicative of the fact that much of this latter area has received previous treatment. Other site characteristics including slope, aspect and general location very likely play a role in shaping the current situation.

Although the majority of affirmative Region 8 survey responses fell into the developed category, this does not indicate that most of the burning for recreation and visual quality is in fact within this end of the spectrum. Undoubtedly many respondents did not even discuss benefits for general dispersed recreation and viewing, particularly when they had burned in a developed facility. Quite often the former was reserved for those with no other "affirmative" response. In any case, results indicate that there is in fact a fairly wide range of uses and options for utilization.

In assessing benefits of other forms of treatment they appear to be fairly effective, however, the cost benefit ratio generally is not positive for more than just a very small area. Prescribed burning on the other hand is relatively low in cost with the same relative benefits. It must also be recognized that there are some physical and environmental constraints with utilizing most of these methods.

Recommendations

Based on tentative, very positive on-site results during the winter of 1987, recommendations for Turkey Fork Recreation Area are as follows:

1. Prescribe burn as needed. Reexamine in one year to determine frequency. Experience indicates may need burned every three to five years.

2. In order to obtain a better perspective on public reaction, conduct a formal random sample survey of visitors to determine public reaction and acceptability levels.

3. Seek out opportunities for personal contact to explain management actions and gain support and understanding.

4. Evaluate use levels and perhaps as part of the informal survey ask users if in fact this type of treatment is a consideration in terms of increasing utilization and/or helping to improve comfort.

General considerations for management and application to the recreation environment have been outlined in Chapter II. Utilization of these guidelines and suggestions when planning a prescribed burn for recreation and visual quality benefits should be helpful in obtaining positive results. At the same time, many of the thoughts presented with modifications to meet specific needs could apply to many different vegetative conditions within a variety of geographical regions and national forests.

Conclusions

There are indeed many potential uses of fire for recreation management, but there are some (Omni and Laven 1982) who would conclude that "widespread implementation of prescription fire programs is hindered by uncertainties concerning fire's impacts on both the physical and psychological settings afforded to individuals and society as a whole. These uncertainties lead to inevitable conflicts over the implementation of progressive fire management programs."

While uncertainties exist in dealing with both the tried and the untried, it is the author's assertion that utilization of prescribed fire in the scheme of recreation management can be very beneficial and in some cases invaluable.

Because of the short-term nature of this study, the results of application alone were inconclusive in terms of the site examined. However, based on literature review, survey data and feedback, as well as preliminary observations, one can conclude that prescribed burning is a proven method in the general forest environment and when carefully applied can be valuable and beneficial in the rural portion of the recreation opportunity spectrum.

APPENDIX

Table 1. - Pre-treatment Understory Stems Per Acre and Average Height (Picnic Area)

Species	0-0.9		1.0-1.9		2.0-2.9		3.0-3.9		4.0-4.9		5.0-5.9		Total	
	#	H	#	H	#	H	#	H	#	H	#	H	#	H
Carya sp.	0	0	0	0	0	0	5	10	0	0	0	0	5	10
Cornus amomum (Mill.)	10	6	0	0	0	0	0	0	0	0	0	0	10	6
Cornus florida (L.)	5	6	10	7	20	10	30	13	25	16	0	0	90	15
Gelsemium semperwirens (L.)	300	6	0	0	0	0	0	0	0	0	0	0	300	6
Grasses (Andropogan, Panicum, Paspalum, Triens, Sporobolus sp)	265	2	0	0	0	0	0	0	0	0	0	0	265	2
Illex cassine (L.)	0	0	0	0	15	8	0	0	0	0	0	0	15	8
Illex coriacea (Chapm.)	50	2	0	0	0	0	0	0	0	0	0	0	50	2
Illex glabra (L. Gray)	990	4	10	7	0	0	0	0	0	0	0	0	990	4
Illex opaca (Ait.)	15	3	10	6	10	15	0	0	0	0	0	0	35	6
Illex vomitoria (Ait.)	165	4	85	9	45	11	10	12	5	15	0	0	310	7
Kalmia (L.)	210	6	25	9	0	0	0	0	0	0	0	0	235	6
Liquidamber styraciflua (L.)	10	3	10	6	0	0	0	0	0	0	0	0	20	5
Lonicera sp.	270	7	0	0	0	0	0	0	0	0	0	0	270	7
Magnolia virginiana (L.)	225	3	0	0	0	0	0	0	5	12	0	0	225	3
Myrcia certifera (L.)	240	2	0	0	0	0	0	0	0	0	0	0	240	2
Pinus taeda (L.)	210	4	0	0	0	0	10	13	30	16	10	35	260	11
Prunus sp.	0	0	0	0	15	13	5	15	10	18	0	0	30	15
Quercus sp.	65	4	0	0	0	0	15	12	0	0	0	0	80	6
Smilax sp.	250	3	0	0	0	0	0	0	0	0	0	0	250	3
Ulmus alata (Michx.)	0	0	5	12	0	0	0	0	0	0	0	0	5	12
Vaccinium corymbosum (L.)	35	5	65	7	15	8	15	11	0	0	0	0	130	8
Vaccinium vacillans (Torr.)	225	1	0	0	0	0	0	0	0	0	0	0	225	1
Total	3540	4	215	9	130	10	90	13	75	16	10	35	4060	10

Table 2. - Pre-treatment Understory Stems Per Acre and Average Height (Campground)

Species	0-0.9		1.0-1.9		2.0-2.9		3.0-3.9		4.0-4.9		5.0-5.9		Total	
	#	H	#	H	#	H	#	H	#	H	#	H	#	H
Carya sp.	5	2	10	7	0	0	0	0	0	0	0	0	15	5
Cornus amomum (Mill.)	15	5	5	5	0	0	0	0	0	0	0	0	10	5
Cornus florida (L.)	20	3	35	5	75	7	65	10	70	14	80	19	345	14
Gelsemium semperwirens (L.)	480	2	0	0	0	0	0	0	0	0	0	0	480	2
Grasses (Andropogan, Panicum, Paspalum, Triens, Sporobolus sp)	805	1	0	0	0	0	0	0	0	0	0	0	805	3
Illex cassine (L.)	60	2	25	4	0	0	0	0	0	0	0	0	85	3
Illex coriacea (Chapm.)	285	3	0	0	0	0	0	0	0	0	0	0	285	3
Illex glabra (L. Gray)	680	3	0	0	0	0	0	0	0	0	0	0	680	3
Illex opaca (Ait.)	25	2	10	3	10	6	5	8	0	0	0	0	50	2
Illex vomitoria (Ait.)	330	3	165	5	70	8	10	9	0	0	0	0	575	4
Kalmia sp.	60	3	0	0	0	0	0	0	0	0	0	0	60	3
Liquidamber styraciflua (L.)	50	2	15	4	15	6	0	0	0	0	0	0	80	3
Lonicera sp.	345	3	0	0	0	0	0	0	0	0	0	0	345	3
Myrcia certifera (L.)	250	2	0	0	0	0	0	0	0	0	0	0	250	2
Pinus australis (Michx. f.)	5	1	15	3	0	0	0	0	0	0	0	0	20	2
Pinus taeda (L.)	550	2	10	3	5	2	0	0	0	0	0	0	560	2
Prunus sp.	0	0	10	5	0	0	0	0	0	0	0	0	10	5
Quercus sp.	165	2	20	5	0	0	0	0	0	0	0	0	195	2
Rhus copallina (L.)	95	4	0	0	0	0	0	0	0	0	0	0	95	4
Rubus allegheniensis (Porter)	165	3	0	0	0	0	0	0	0	0	0	0	165	3
Smilax sp.	590	2	0	0	0	0	0	0	0	0	0	0	590	2
Ulmus alata (Michx.)	10	3	15	6	0	0	0	0	0	0	0	0	25	3
Vaccinium corymbosum (L.)	125	5	0	0	0	0	0	0	0	0	0	0	125	5
Vaccinium vacillans (Torr.)	580	2	0	0	0	0	0	0	0	0	0	0	580	2
Total	5705	2	345	5	175	8	80	16	70	14	80	19	6460	3

REGION 8 - SOUTHERN REGION

FY 86 ANNUAL ACCOMPLISHMENT OF PRESCRIBED BURNING

National Forests	Fuel Reduction	Brown Spot	Site Prep	Seedbed Prep	Understory Control	Range	T & E Wildlife	Pre-Species	Total Mark	Acres
Alabama	25777	294		4548	3298	2784	19700			56401
Chatt-Oconee	2239		104	646			499			3488
Cherokee				1808			145			1953
Daniel Boone	983			309		90	74			1456
Florida	62355	727	1248	4458	149	5323	26900			101160
Fr. Marion/Sumter	32630			92	1437		12880		3262	50301
G. Washington	1				18		170			189
Jefferson	206			100		150	10			466
Kisatchie	17460			2729		9750	19329	3860		53128
Mississippi	62710	1024	7260		25071	9117	11291		2184	118657
North Carolina	6601		903				1497			9001
Ouachita	4633			3659		1401	12220			21913
Ozark/St.Francis	1220			1257	54	411	2893			5781
Texas	12983	38				7506	17536	185		38248
Total Acres	229798	2083	9515	19606	30027	36532	125144	4045	5446	462142

Table 4.

RECREATION USE 1983 - 1986 (MRVDS)

Turkey Fork Recreation Area

Activity	Year 1983	1984	1985	1986
Boating	0.5	1.0	1.2	1.2
Camping	2/ 8.5	3.3	3.9	4.2
Fishing	1.8	1/ 2.0	2.0	2.0
Games/Play	0.2	0.1	0.3	0.3
General Information	0.1	0.1	0.3	0.0
Hunting	0.1	1/ 0.1	0.5	0.5
Nature Study	0.0	0.0	0.0	0.1
Picnicking	4.3	4.2	2.5	2.5
Swimming	4.5	4.5	3.0	3.0
Touring - Walking	0.0	0.0	0.0	0.2
Viewing Interpretive	2.7	2.6	1.6	1.4
Waterskiing	3.8	1/ 4.0	4.0	4.0
Total	26.5	21.9	19.3	19.4

1/ Reliability based on simple observations, comparisons, or estimates by field personnel. All other figures were obtained from reliable traffic count systems, visitor registration systems or calculation techniques.

2/ Camping figures for 1983 were documented to be high with low reliabiltiy for accuracy.

Vicinity Map

U.S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE
R. MAX PETERSON, CHIEF

DE SOTO NATIONAL FOREST

CHICKASAWHAY RANGER DISTRICT

MISSISSIPPI
ST. STEPHENS MERIDIAN

RECREATION SITES	LOCATION	BOATING	CAMPING	DRINKING WATER	FISHING	HIKING TRAILS	PICNICKING	SANITARY FACILITIES	SKIING	SWIMMING	TRAILER DUMP STATION	TRAILER SPACE
TURKEY FORK	E-4	L	F	●	●	●	●	●	●	F		●

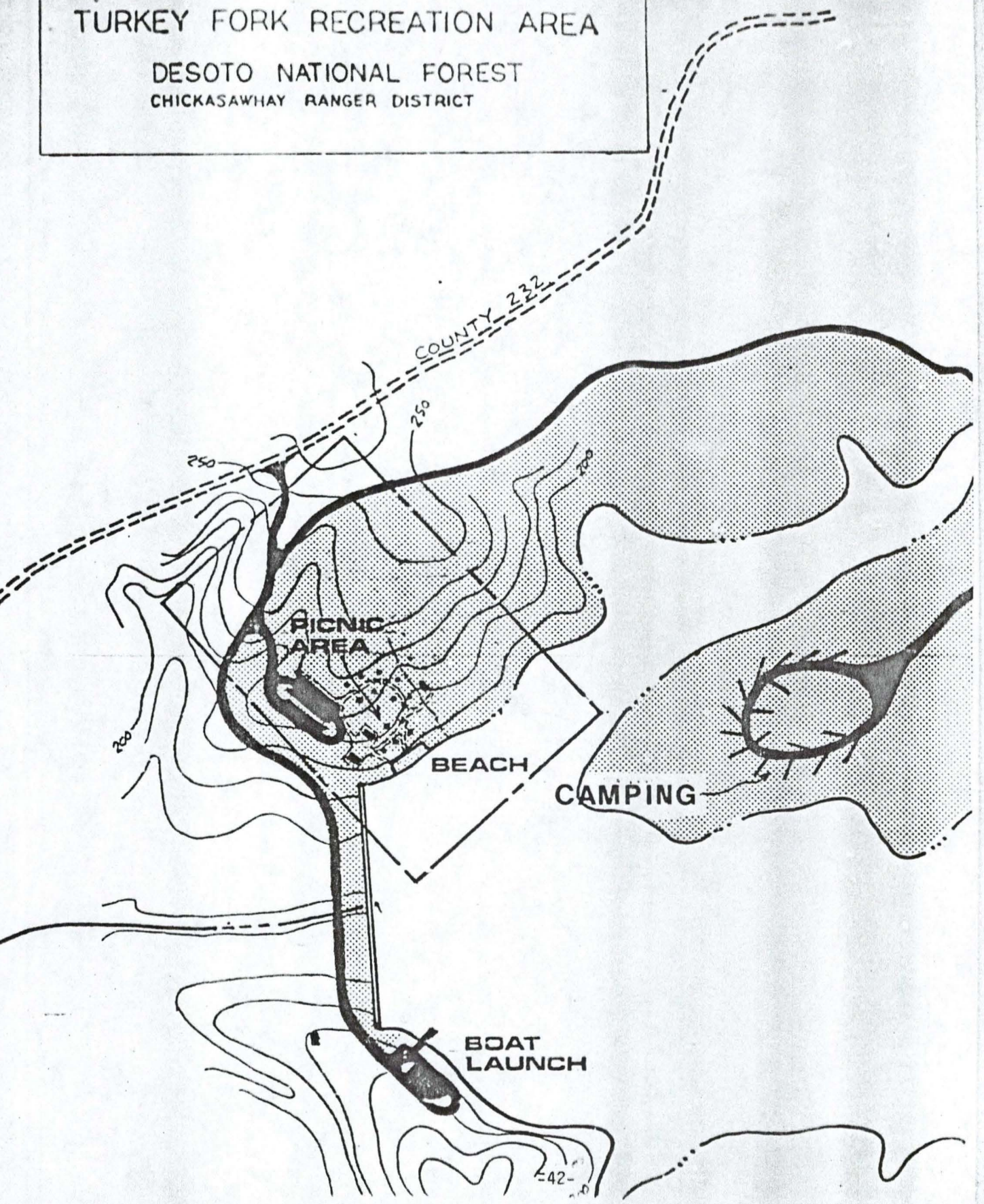
FEE AREA=F
LAUNCH RAMP=L
ELECTRICAL MOTORS ONLY=E
CARRY DOWN ACCESS=A

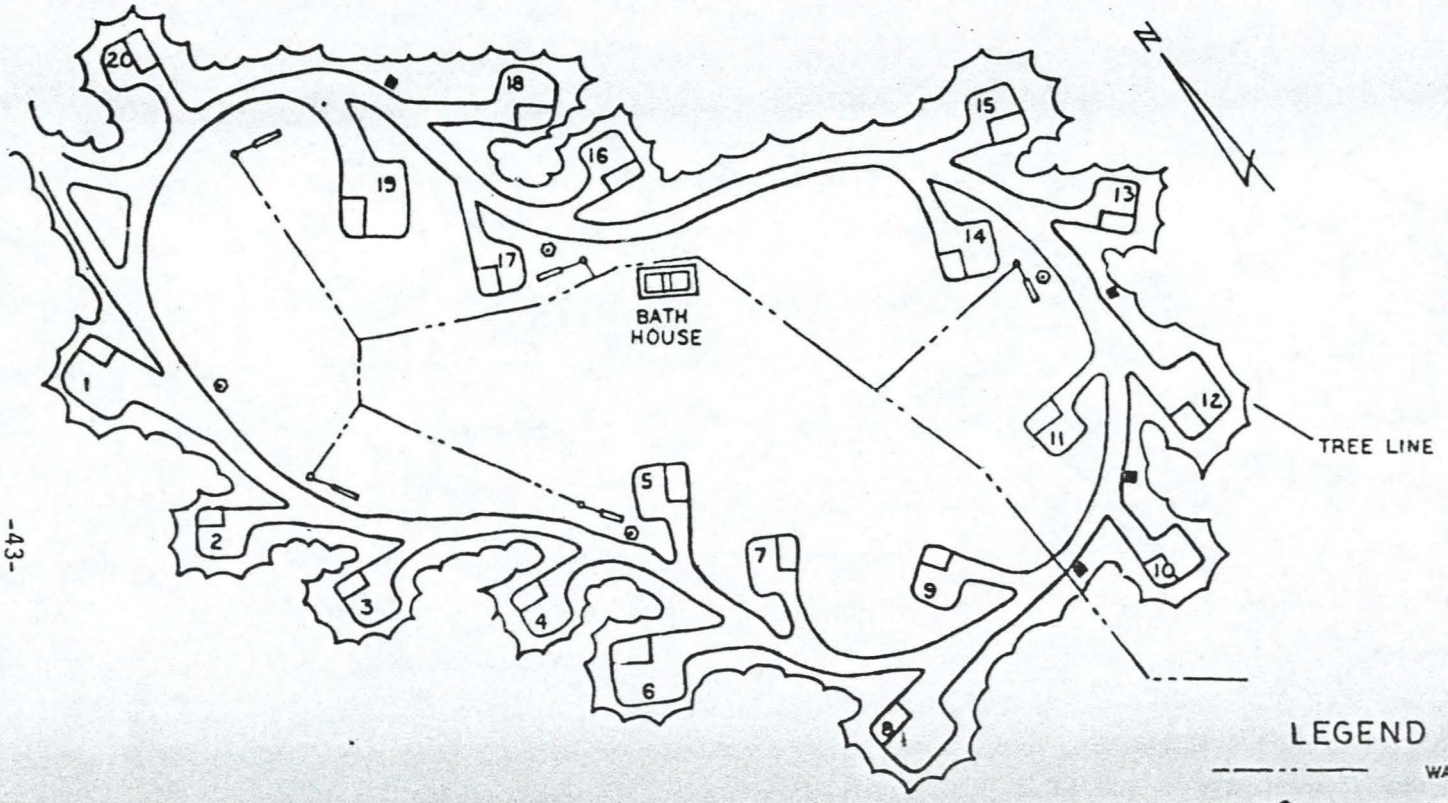
EXHIBIT B

TURKEY FORK RECREATION AREA

DESOTO NATIONAL FOREST

CHICKASAWHAY RANGER DISTRICT





LEGEND

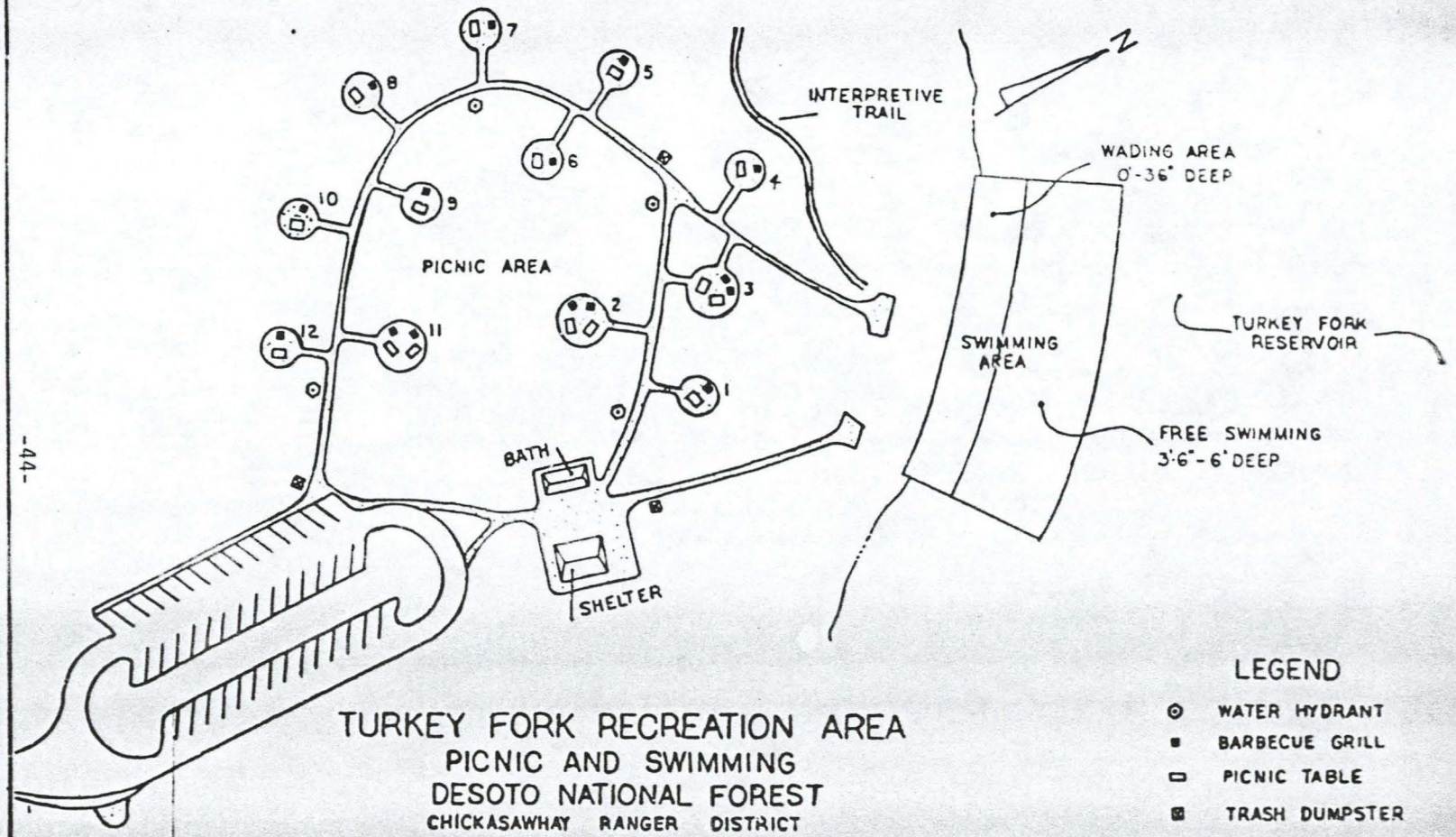
WATER LINE

WATER HYDRANT

TRASH DUMPSTERS

TURKEY FORK RECREATION AREA
CAMPGROUND
DESOTO NATIONAL FOREST
CHICKASAWHAY RANGER DISTRICT

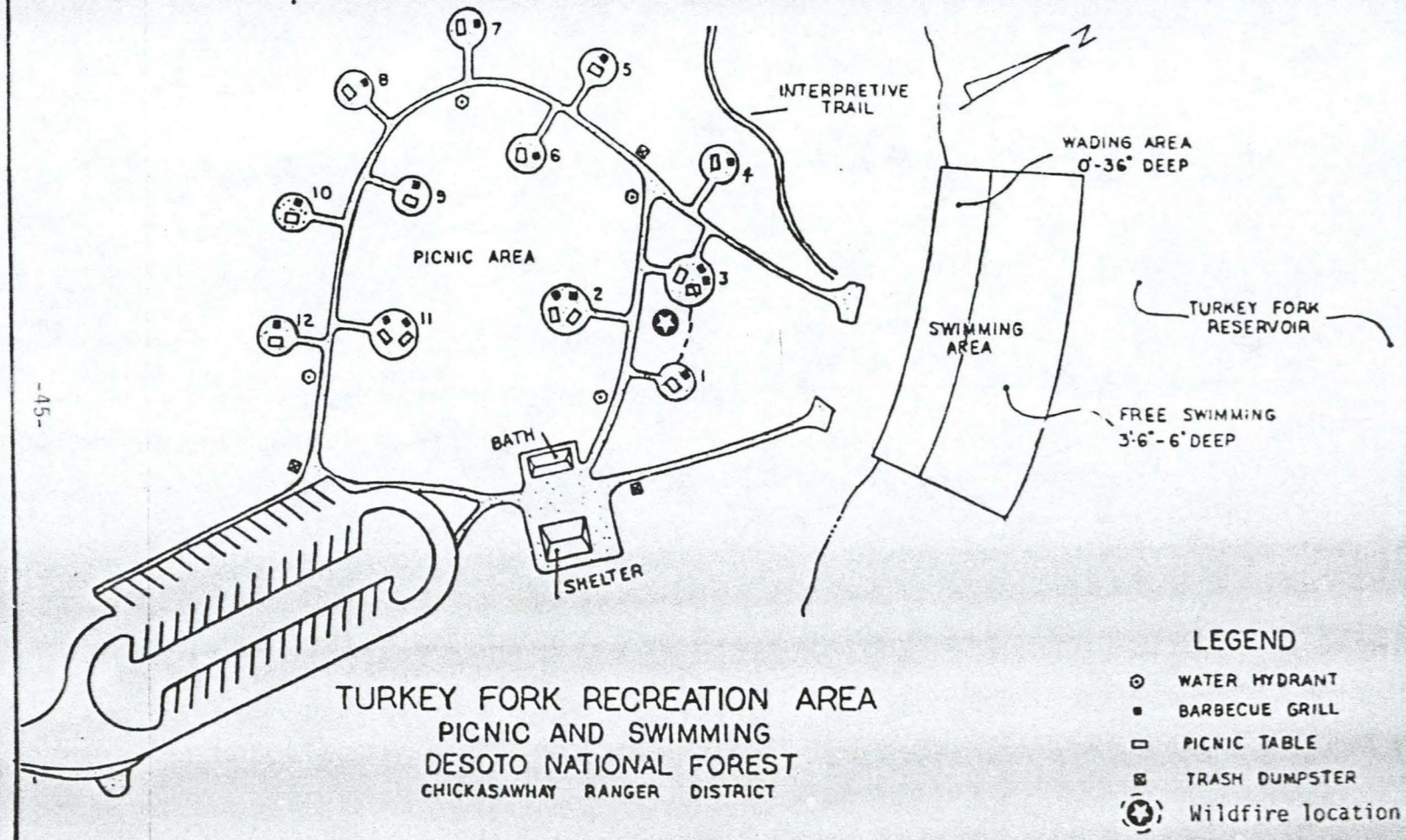
EXHIBIT C



TURKEY FORK RECREATION AREA
PICNIC AND SWIMMING
DESOTO NATIONAL FOREST
CHICKASAWHAY RANGER DISTRICT

EXHIBIT D

WILDFIRE LOCATION MAP



TURKEY FORK RECREATION AREA
PICNIC AND SWIMMING
DESOTO NATIONAL FOREST
CHICKASAWHAY RANGER DISTRICT

LEGEND

- WATER HYDRANT
- BARBECUE GRILL
- PICNIC TABLE
- TRASH DUMPSTER
- Wildfire location

EXHIBIT E

PRESCRIBED FIRE PLAN

A. Location and Administrative Information:

Ranger District Chickasawhay FY 87 Purpose rough reduction recreation/visual management

057115

Acres 194 Mgmt. Code 057071 Est. Cost 1092 Compartment/Stand 463

Township 4n Range 7W Section 4

B. History of Previous Burn: 1981 - rough reduction

C. Description of Burn Unit:

1. Overstory loblolly pine sawtimber/poletimber with scattered mixed hardwood; BA 70-100
2. Understory herbaceous plants, woody shrubs and vines medium to heavy
3. Fuels Pine needles, hardwood leaves, grasses and gallberry 4+ year old rough
4. Topography generally flat with some gentle slopes - no erosion potential
5. Chains of Line to Establish Utilize hardwood sites, road and lake as boundary, construct permanent fire break 15ch 232-A2 to lake in stand 32. and adjacent to private land

D. Specific Objectives: 1. Reduction of hazardous fuels accumulation
2. Improve visual quality and viewing to the lake
3. Improve air circulation patterns.

E. Special Considerations: 1. Developed facilities and improvements in both campground and day use areas
2. Interpretive trail and improvements in hardwood drains - Stand 31
3. Protection of planted ornamentals and shrubs.
4. Scorch should be kept to minimum (ie 5 feet bole scorch max.)

1. Hazard Analysis: Refer to district files; burning boss will review prior to executing burn

a. Fire Shelter required No

2. Public Notification

Name	Contact Method
MFC	telephone
Forest users	personal contact
Private	personal contact

3. Coordination with other Resources: Visual resource management - execute burn so as to create small openings and views to create natural appearing edges

F. Prescribed Burn Execution:

1. Organization: Burning Boss 1

Firing Boss Same person as burning boss

Crew Size 4 minimum - includes burning boss

Equipment One tractor-plow unit; pumper or backpack pumps.

2. Firing, Containment, Mop-up and Patrol Procedure: Utilize primarily backing and flank fire from sites to lake; some stripping may be needed outside developed facilities. Utilize standard R-8 mop-up procedures

3. Action Plan: Maintain contact with dispatcher and other units; initiate standard procedure for uncontrolled fire. Utilize only qualified personnel for planned or suppression activities.

G. Smoke Management

1. Initial Screening System

a. Smoke Sensitive Area(s) Identified: FDR 232 and 232-A2, HWY 42 Turkey Fork Reservoir, County Road 230, private homes in vicinity

b. Critical Targets Identified: Chickenhouses in T5N R7W Sec. 32 and T4N R7W Sec. 6 Communities of Sand Hill and Richton

		2/3/87				2/11/87		2/12/87	
	Planned	am	pm	Forecast				am	pm
2. Transport Windspeed:	≥ 35 M/S	2.6	7.7	6.3	8.5			7.9	11.6
3. Mixing Height:	≥ 500 M	80	500	110	950			340	1730
4. Direction:	NW - SE	SE		SW				SW	

5. Smoke Management Criteria Met:

Yes X OK to proceed

6. State Burning Permit number and date: #59 2/3/87 #66 2/11/87 #72 2/12/87

H. Spot NOAA or FWIS Weather Forecasts:

Time/Date: 0800 2/3/87, 2/11/87, 2/12/87

1. Sky PC , PC, PC
2. Precipitation N, N, N
3. Duration N, N, N
4. Cold Fronts N, N, N
5. Windspeed and Direction V-5
   SW-10
   SW- 7
6. Highest Temp. 60, 70, 70
7. Lowest Relative Humidity 50, 30, 40
8. Atmospheric Stability/Stag Index 3,0,3
9. Predicted BI 11, 36, 26
10. Predicted IC 5, 38, 20

Prescribed Parameters, On-Site Observations and Fire Behavior Calculations:

				* PRESC 2/PARAM.	TEST FIRE 1200 (TIME) 2/3/87	POST FIRING 1500 (TIME) 2/11/87	POST FIRING 1430 (TIME) 2/12/87	POST FIRI (TIME
Input Data		HP-71B Calculator						
*		Model # Fuel Model Number (1-99)		7	7	7	7	
*		Relative Humidity		20-65	46	59	47	
*		Temperature		≤80	73	69	74	
*	1-H	Fuel Moisture		5-20	12.8	5	7.4	
*	10H	10-H Fuel Moisture	(1-60%)		22.0	10	11	
2/	100H	100-H Fuel Moisture	(1-60%)		16.56	17.49	17.47	
2/	Herb	Live Herb Moisture	(30-300%)					
2/	Wood	Live Woody Moisture	(30-300%)		70	70	70	
	MFWS	Midflame Windspeed	(0-99 MI/H)		3	4	3	
	SLP	Slope	(0-100%)		1	1	1	
	WD1R	Direction of Wind *(N,E, etc. for desired Dir.) (0-360-Behavior)			SE	SW	SW	
OUTPUT (RUN)								
2/	ROS	Rate Of Spread	CH/H		1	2	2	
2/	H/A	Heat Per Unit Area	BTU/FT		453	542	506	
2/	FLI	Fireline Intensity	BTU/FT/S		11	18	15	
*	FL	Flame Length	FT	2-4	1.3	1.7	1.6	
	RI	Reaction Intensity	BTU/Ft/Min	XXXX	18.32	21.89	20.43	
2/	EWS	Effective Windspeed	MI/H		0.0	0.1	0.0	
	MAXD	Maximum Spread Dir.		XXXX	SE 2	SE 3	SE 4	
2/		Ignition Probability						
		Observed Flame Length	Ft.	XXXX				
		Observed Rate of Spread	Ch/Hr.	XXXX				
*		Time of Year to Burn/Burned		Jan-Mar				
*		Type Fire to Use/Used		Backing-flank				
2/		Cumulative Severity Index	(0-800)		6	17	24	

*Required Items to be Completed at Time of Planning
2/Optional
3/Show range of parameters

K. Action to be taken when conditions change from that planned rendering burn out side prescription:

Burning boss will contact District Ranger to request any revisions.

L. Plan Preparation and Execution Approval:

1. Prepared By and Date: Jimmie T. Shuster 1/26/82 Fire Manager
Name and Prescribed Burning Organization Titles

2. Resource Coordination: _____
Name and Resource

3. Reviewed By and Date: _____
Name and Organization Title

4. Approved By and Date: Bobby J. Burns 1/27/82
Approving Line Officer

5. Execution Approval Date: _____
Prescribed Fire Manager or Burning Boss

6. Change Approval and Date: _____
Approving Line Officer

M. Attachments:

1. Descriptive Map of Area (required).

2. Other attachments as may be necessary or desirable.

N. Test Fire Required: Yes

Test Fire Results Indicated Objectives Will Be Met: _____
Burning Boss

2/3 2/11 2/12
Date

O. Fire Declared Out: Morgan V. Manley 2/12
Burning Boss Date

P. Notes:

Q. Post Burn Evaluation: 1/

1. Date: 2/3/87, 2/11/87, 2/12/87 Date: _____

*2. Amount Litter Left (inches): 1" or more

3. Understory Vegetation Consumed (%): 40%

4. Scorch: 20% of Area with Crown Scorch of 25-50% ___ 50-70% ___ 75%+ ___

*5. Spotting: none

6. Tree Damage (insects, disease, mortality): none

7. Understory Kill of Undesired Vegetation (%): 40%

*8. Any Smoke Management Violations: none

9. Any Escape: none

*10. Any Complaints (explain): none

11. Adverse Effects: none

12. Restoration Needed: seed plowed line on west side of campground

13. Objectives Met (results): yes

Evaluation By: _____ 3/10/87
Name Date

(Recommendation for future evaluation): yes should check this summer from May-June 1987
Date

Evaluation By: _____ _____
Date

*Evaluate Immediately After Burn

1/ Attach Additional Sheets as Necessary.

USDA-Forest Service

EXHIBIT G

LANDSCAPE MANAGEMENT ANALYSIS

A. Viewing Location(s) Turkey Fork developed facilities and reservoir - Viewed as: FG X, MG ___, or BG ___

B. Visual Quality R X, PR X

C. Proposed Activity Prescribed burning in and around developed facilities (R) and along county road 232 (PR)

D. Landscape Character Description (Existing) — Visual Resource Impacts

1. Form: Flat X, Rolling X, or Heavily dissected ___ — form will not change

Expressed in: landform in and around sites is somewhat rolling but overall flat characteristcs

2. Line: Straight ___, Curving X, Vertical X, or Horizontal X, — Lake-shore line will become more visable; tree boles will become more distinct

Expressed in: hardwood sites, lakeshore trees, county road

3. Color: green, browns, blue — blackening effect of P. burning will be short-lived but will occur until green-up improvement in viewing of blue in lake will enhance VQ

Expressed in: Trees, vegetation, developed structures, lake

4. Texture: Coarse ___, Medium X, or Fine ___ — will reduce texture - courseness through understory manipulation

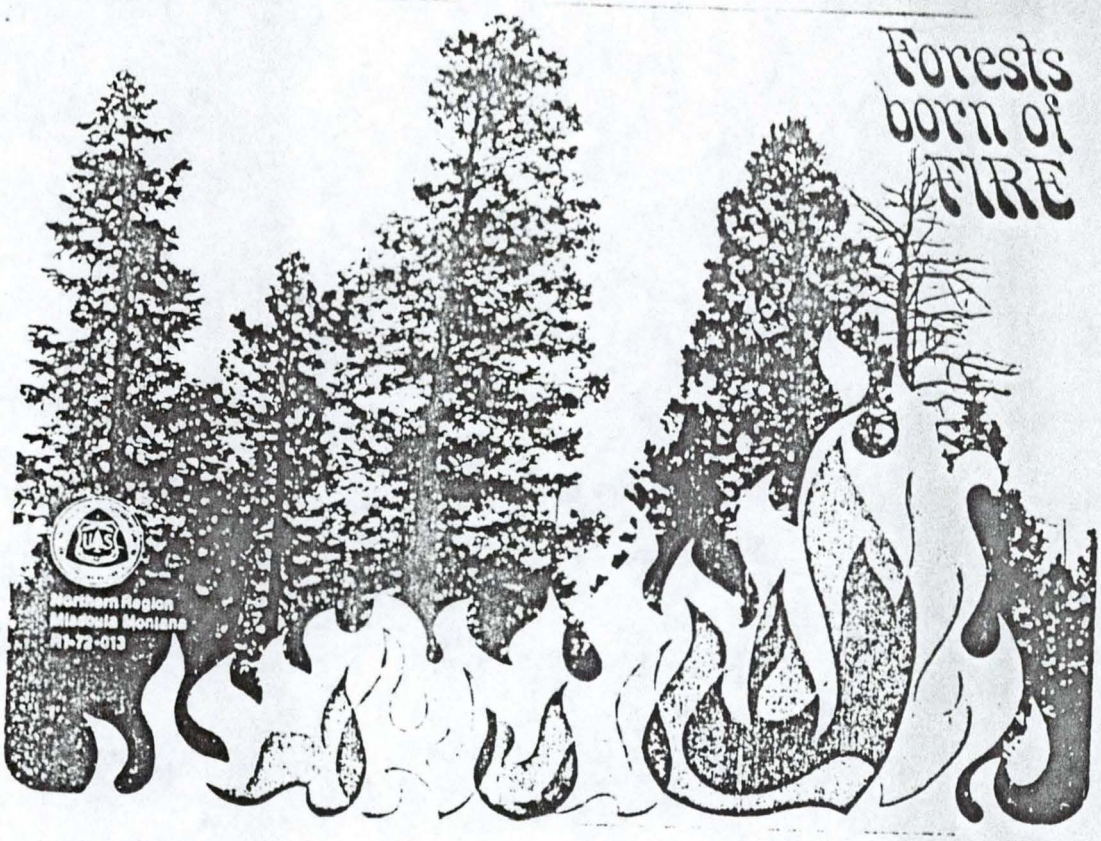
Expressed in: understory vegetation tree crowns

E. Contrast Rating: Rate the degree of contrast that will be caused by the proposed act.

ELEMENTS	RATING		DEGREE OF CONTRAST (Circle One)	
Form	4	X	1, 2, or 3	4
Line	3	X	1, 2, or 3	3
Color	2	X	1, 2, or 3	2
Texture	1	X	1, 2, or 3	1
			TOTAL	10

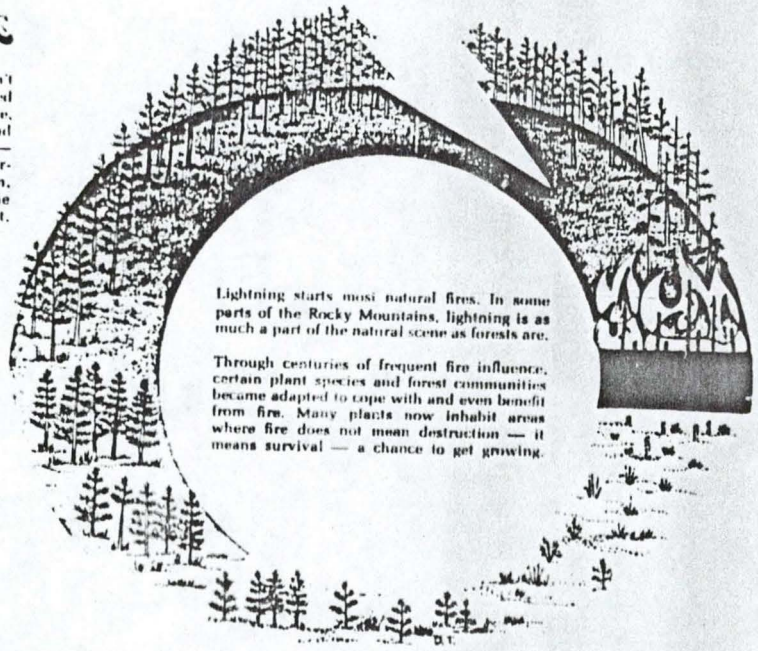
Meets visual quality objective YES X NO ___

Reference input obtained from Landscape Architect (D.Ashworth) Fs-2300-1 (8/82) and incorporation into p. burning plan.



Forests born of FIRE

That sounds incredible! After all, isn't fire the traditional enemy of forested lands? Modern equipment detects fire, top-notch trained crews suppress it, and Smokey warns against its careless use — ALL WITH JUST CAUSE! Fire is a powerful force. Out of place, out of proportion, it is a serious threat to man and the earth that gives him life and enjoyment.



Lightning starts most natural fires. In some parts of the Rocky Mountains, lightning is as much a part of the natural scene as forests are.

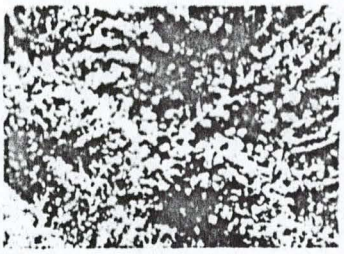
Through centuries of frequent fire influence, certain plant species and forest communities became adapted to cope with and even benefit from fire. Many plants now inhabit areas where fire does not mean destruction — it means survival — a chance to get growing.

But many forests of the Rocky Mountains are indeed born of fire. Forests are natural systems of living things, fire is a natural force, and the two have "grown up" together over the more than 12,000 years these forests have lived here.

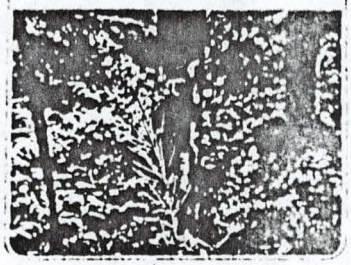
Fire causes some important changes in forest systems. It creates openings, and converts to ash those parts of plants that store minerals — the living stems, leaves, and bark, and the dead materials (litter) that accumulate on the floor of a developing forest. In ash form, most of these essential mineral nutrients are dissolved by rain and returned to the soil — recycled for use. Plants in forests born of fire take advantage of those changes. Continuation of healthy forestands in the Rocky Mountains requires this cycling.

The seeds of western white pine also germinate well in sunlit openings on mineral soil provided by fire.

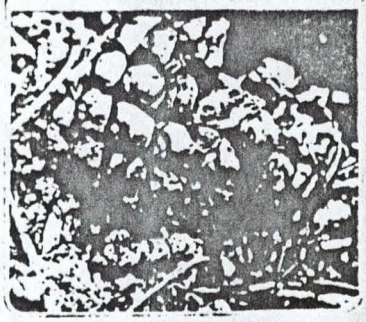
Flowering plants successfully establish themselves on burned areas, flourishing in full sunlight and lack of competition from other vegetation. Many of their own seeds will not sprout the following year due to shade and competition they themselves create. The seeds do provide food for many birds and small mammals who also "pioneer" recent burns.



Most pine trees have cones that open as soon as they are mature. On some lodgepole pines, however, the majority of cones remain closed. They open and release seed only when heated. Fire is the usual process by which closed-cone stands regenerate. Many seeds that have been held in cones for 50 years or more survive the short exposure to high temperatures generated by ground fires.



The seeds of Ceanothus, an important food plant for elk and deer, can remain stored in the forest litter for many decades. They are free to germinate when fire conditions the seed coat and changes the litter to ash.



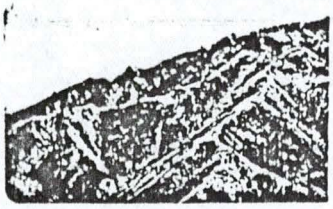
Fire in some forest systems keeps browse species "young" — palatable and low-growing for animal use — by encouraging the growth of sucker shoots from underground buds.

The thick bark of ponderosa pine and western larch trees insulates the inner, living tissues from heat. Not only do adult trees of these species survive many fires, but the fire-caused changes in the forest provide suitable conditions for their seeds to germinate.

As systems of living things, forests are a lot more than just trees. They are whole communities of different kinds of plants and animals taking from and giving to the soil, air, and water around them. Forests change with time. The role that fire historically played in directing some of these changes must not be overlooked.

It is not always fair to observe and evaluate these changes in terms of our life span — so short compared with that of a forest. The cycle of life and death in some forest types is evidenced as a cycle of green and black, and the black must be appreciated as a necessary part of the cycle.

Forests change and times change. Fire played its natural role in vast, unpopulated areas. But today, man is very much a part of the forest system. Demands for forest goods and services are constantly increasing, and forest systems have to be managed to provide them. As a part of forest systems, fire, too, has to be managed.



But in wildernesses and other areas managed to perpetuate natural conditions, man-made, mechanized systems cannot be used to replace fire's role. In selected portions of wilderness, it is environmentally sound to permit fire to more nearly resume its centuries-long role in harmony with the wilderness objective of perpetuating natural forest communities.

In some forested areas, trees are harvested, not left to burn. Man assumes the role of fire in these harvesting activities, and also by mechanically treating slash and planting trees. When it is determined best for the forest system involved, man also uses prescribed, controlled fire to remove the litter and prepare a seed bed.

While there are many beneficial effects of fire when it is carefully and professionally used, there are also forest systems that are not adapted to fire. There are areas where fires could seriously damage valuable resources and endanger lives. Any application of fire must consider the effects of smoke on air quality across the land. And, unfortunately, there are those who do not respect fire for the powerful force that it is.

PLEASE CONTINUE TO BE CAREFUL WITH FIRE! As a powerful force of Nature, fire is not to be fooled with.

Your State Forester
in cooperation with
U.S. Department
of Agriculture
Forest Service

PA-64

YOU and FOREST FIRES

Using Controlled Fire For Special Purposes

Techniques have been developed that make it possible for a forestry expert, at certain times and under very careful control, to accomplish special needed results by using fire. Fire then becomes a useful tool for the land manager to improve and protect the forest. Under these conditions, fire may be used to:

1. Control certain insects and diseases.
2. Eliminate scrubby, undesirable growth such as inferior hardwood trees in stands of southern pine.
3. Expose mineral soil so that seeds of desirable tree species—like Douglas-fir in the West—will germinate and grow.
4. Safely clean up heavy underbrush or limbs that remain after logging, which otherwise might cause a disastrous wildfire.
5. Open up small areas in the forest so that shrubs and herbs will grow and provide needed food and cover for wildlife.

When fire is used by trained and experienced foresters for a necessary purpose, it is called *prescribed burning*. Foresters use great care and advance planning when using prescribed burning. They make sure that temperature, humidity, wind, and other weather conditions are right. A fire lane, road, stream, or other barrier is used to form borders around the area to be burned so that the fire cannot easily spread beyond. Foresters have fire control equipment and crews on hand to stop any possible undesirable spread.

Whichever of the constructive purposes burning is done for, the job gets done safely only by a professional trained in the use of fire.

EXHIBIT 1

ABOUT YOUR SMOKE

General Report SA-GR 23
April 1982

U S. DEPARTMENT OF AGRICULTURE • FOREST SERVICE
Southeastern Area, State and Private Forestry
1720 Peachtree Road, N.W., Atlanta, Georgia 30367
in cooperation with
SOUTHERN STATE FORESTERS AND EXTENSION SERVICES

Fire Laws and Safe Burning Practices

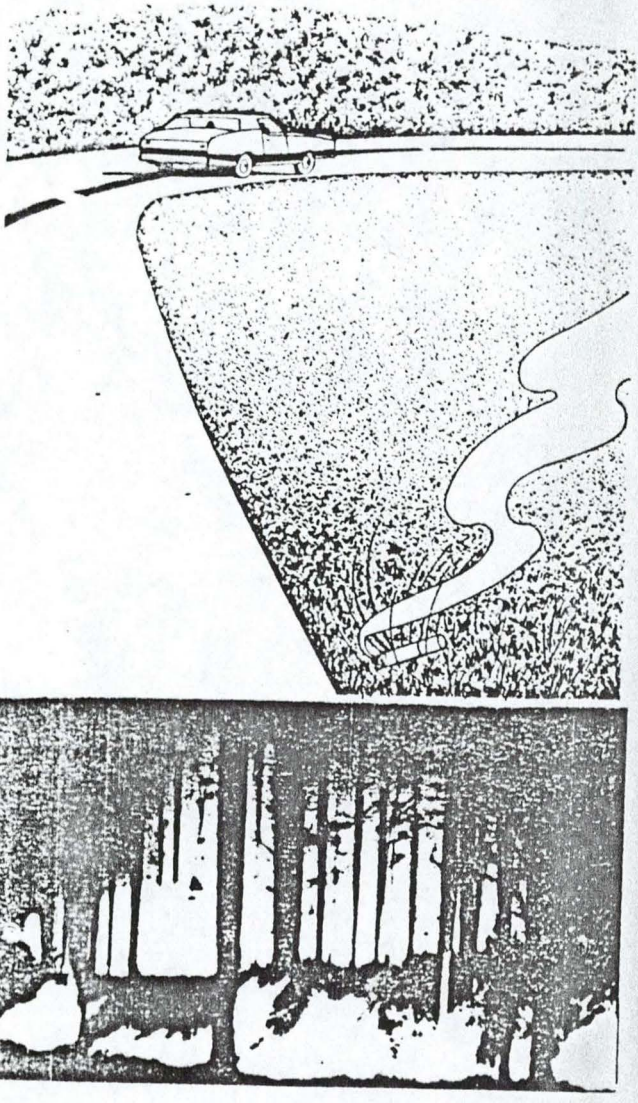
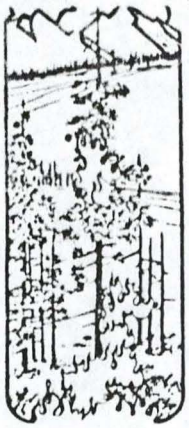


EXHIBIT L



Fire Management is More than Fire Protection

Fire's Role in Land Management

Early day Forest Rangers saw wildfire as a dreaded enemy. At best, wildfire was considered an intolerable nuisance. Forest and range fires were widespread and considered totally destructive.

Today, wildfire is still a tenacious foe, but fire is now recognized as a natural phenomena and as integral part of the forest environment. Fire benefits many ecosystems and is often necessary to sustain quality land management.

Depending upon management objectives, the effects of fire can be either detrimental or beneficial. Frequently the results are a combination of both. Harnessing fire's destructive potential, while utilizing its benefits is the foundation of a fire management program.

Fire management involves more than traditional protection, suppression and prescribed burning. It is not simply striking all fires at all times and at all places, nor is it just letting them burn.

Land use planning determines when and whether fire is needed in an area. Fire management describes how fire—natural or prescribed—can be used to achieve land management objectives within sound ecological, environmental and economic objectives and constraints. Fire management is designed to meet forest fuel energy conversion requirements. It combines smoke management, fuel conversion, habitat type regeneration and fire control in achieving quality land management, as prescribed by land use planning.

A Broadened Concept

Fire management—with other resource uses, activities and ecological and economic considerations—must contribute to the development of and be responsive to the forest management direction and land unit prescriptions. Management directions and unit prescriptions are designed to protect the long term potential of the land and its resources and to manage them in harmony with the nation's needs. Management direction must provide a balanced program of resource management without damage to the environment. The resources may be utilized, but only in a way which will protect the soil and other resources. Resource uses is determined by land use planning that indicates the use or combination of uses for individual land units. Land descriptions, situation statements, and assumptions about future uses and needs all contribute to the development of coordinating requirements. These coordinating requirements guide activities, help resolve use conflicts, and direct land use planning. Assessment of the ecological role of fire starts with the land use planning inventory and continues throughout the process. The process is illustrated by the diagram on page 7.

Fire has to be considered in its ecological relationship to the blend of resource values that can be achieved by good land management. Planning designs permit the use of fire with a broadened perspective. These include fire prevention, detection, presuppression and suppression, preattack planning, fuel management and prescribed fire—both natural and man ignited. They are all fully integrated with other National Forest land management functions.

Fire Data Supports the Land Use Planning Inventory

Land unit inventories provide a foundation for management decisions, including fire. Base information regarding fire's influence on all resources must be inventoried. By relating fire data to other ecological information, land managers can better describe and predict how fire will affect, or can be used to accomplish, management objectives. Fire data is used with other ecological information in the planning process; thus, fire management becomes a part of the multiple use prescription. Land unit inventories include the following fire data:

- Fuel quantity and characteristics.
- Frequency and historical role of fire, including fire's influence on the origin and perpetuation of flora and fauna in each habitat type.
- Descriptions of on-site effects of fire and/or impacts of fire exclusion.
- Effects of fire intensity on soil and water conditions.

Land Prescriptions Give Fire Management Direction

Land unit prescriptions should include considerations of the following fire management relationships:

- Where, when, why fire is needed and constraints on fire's use.
- Where, when, why fire is to be excluded.
- Where, when, how to substitute for fire's natural role.
- Constraints to protect land values from damage that could result from fire suppression.

From this data, fire activities can be planned to meet the needs of each management unit.

Fire Programs are Designed to Support Land Management Objectives

To achieve productive forests in a quality environment requires full interaction of fire programs with all other activities influencing the land's life communities. In this realm of fire specialists prepare and execute fire management programs to implement land management decisions.

Today fire management is more land related. Programs once intended to banish fire are now being expanded to include activities such as fuel management and prescribed use of wildfire. Modern fire programs require:

- Recognition of fire as a natural force.
- Consideration of fire's ecological role in determining land management objectives and activities.
- Application of fire protection, prescribed burning and prescribed use of wildfire to achieve planning objectives.

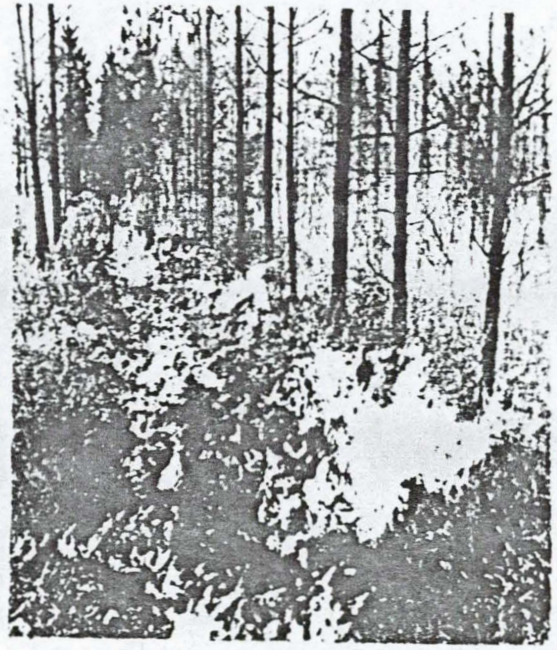
To implement fire management needs across the Region's National Forests, land managers and specialists must master three concepts:

- Understanding fire as a process in wild land ecosystems and fire's physical and chemical influence on biological systems.
- Integration of knowledge of fire processes with the management objectives of a specific land unit (fire management unit).
- Constraint on fire management actions to control the consequences, including damage from both fire and fire suppression actions.
- Application of current "how to" technology of fire management.

To use fire in land management requires the integration of fire data and knowledge at all levels of land management planning and decision-making. Only then can fire protection, prescribed fire, and prescribed use of wildfire be employed to fully and effectively support the objectives for each ecological or land planning unit.

Wildfire is now understood to involve a "triangle" of causes: weather, ignition, and fuel. Of the three, only fuel is manageable. "Fire weather" which occurs during the hot dry months is unpreventable. Ignition can only be partially controlled since lightning as well as careless or malicious people cause wildfires. Fuel production is inherent in the growth of forests. Preventing excessive fuel accumulations, therefore, is the only feasible strategy for eliminating devastating wildfires.

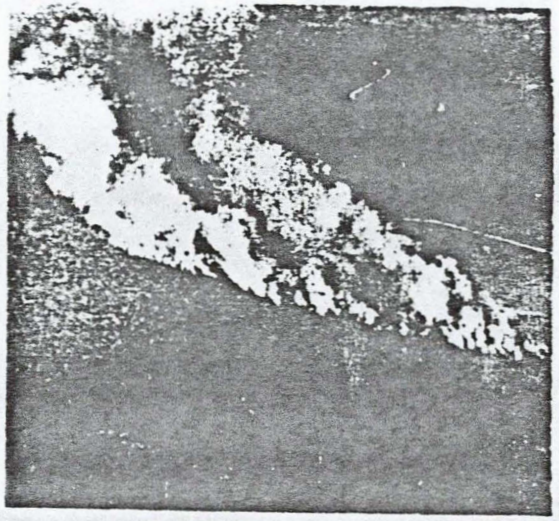
The only ecologically and economically sound way to dispose of fuel accumulations is by prescribed burning under suitable conditions. Removing fuel with a "cool" fire in winter when the temperature is low and the ground moisture is high removes the threat of catastrophe. Today, foresters recognize that periodic prescribed fires maintain forests in a condition that is more ecologically stable as well as more pleasing and useful to people.



PERSPECTIVE

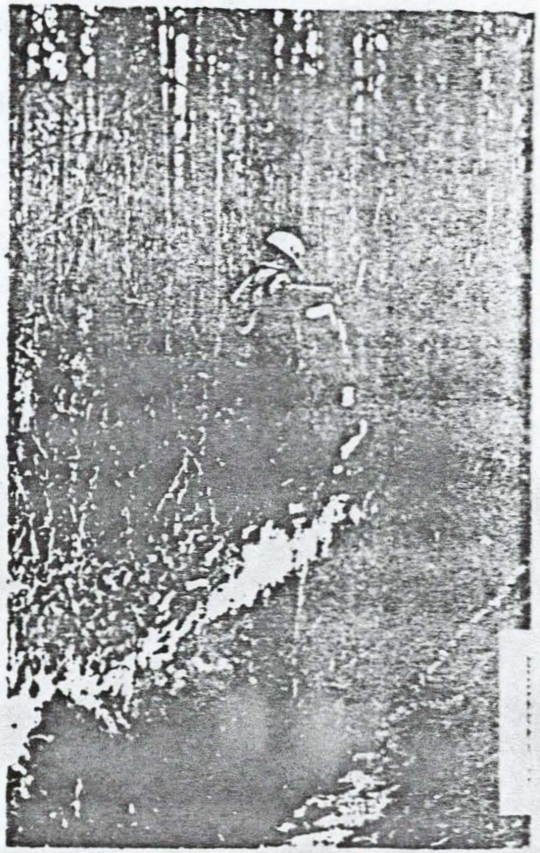
An appreciation of prescribed fire as a sound forest management tool is displacing the past image of fire as a mortal enemy of southern forests. Attempts to exclude fire over large areas have inevitably resulted in large fuel build ups and catastrophic wildfires that destroyed life and property within and around forests. By managing fire, we work with nature rationally and economically. Indeed, where alternative techniques for achieving a forest management objective exist, prescribed fire is invariably most ecologically sound and energy efficient.

The many uses of fire reflect the versatility of prescribed fire in achieving timber, wildlife and aesthetic values. As aerial ignition and other advanced technologies increase safety and effectiveness, prescribed fire is becoming an increasingly important tool in sound land stewardship.



INTERNATIONAL PAPER COMPANY

FOREST FIRE BY PRESCRIPTION



INTERNATIONAL PAPER COMPAN

United States Department of Agriculture | Forest Service | Chickasawhay Ranger District | 418 S. Magnolia St. P.O. Box 426 Laurel, MS 39441

Reply to: 2300
5100

Date: December 3,1986

Subject: Prescribed Burning - A Recreation Management Tool

To: Forest Supervisor

In partial fulfillment of requirements for completion of the Professional Development for Outdoor Recreation Management short course, I will be preparing a home paper and will be looking at the subject of prescribed burning as a recreation management tool. We are planning on implementing prescribed burning at Turkey Fork Recreation Area this winter as part of the project. These developed facilties located on the Chickasawhay Ranger District in south Mississippi are relatively new and the area has never received a prescribed burn.

During the current planning phase and as an attempt to gather some background on how prescribed burning has been used as a recreation management tool, I've decided to obtain some basic information from other units within the region. Although it is recognized that burning has and continues to be an active part of vegetation management in and around recreation facilties particularly in the coastal plain regions, not much has been written about the benefits, uses and effects in this regard.

At this time I would appreciate your assistance in distributing the attached information and questionnaire to individual units that have done burning and/or provide feedback. In order to meet project deadlines, I would ask for responses by January 30. Negative replies are requested. If there are questions or further clarification needed please don't hesitate to call (601) 428-0594.

Sincerely,

LAURIE L. SHORTESS
Resource Assistant

cc: S.O (Braddock,Jackson,Marsalis)

PRESCRIBED BURNING QUESTIONAIRE

1. Has prescribed burning been used as a visual or recreation management tool on your forest or district? How often has it been used?

2. Describe objectives and goals of the project(s).

3. What are the environmental conditions when utilized (vegetation, topography, weather, etc.)?

4. Describe any problems encountered.

5. Describe public reactions or feedback received.

6. Provide brief description of effectiveness.

7. Other comment or general information. Please include other known sources or persons who could provide additonal information.

8. Person providing information (include position, address,phone):

PLEASE RETURN TO: DeSoto National Forest
Chickasawhay Ranger District
P.O. Box 426
Laurel, MS 39441
ATTN: Laurie L. Shortess

BIBLIOGRAPHY

Ahlgren, I.F. and C.E. Ahlgren. 1960. Ecological Effects of Forest Fire Bot. Rev. 26:483-533.

Anderson, C.M., D.J. Levi, T.C. Daniel, and J.H. Dietrich. . The Esthetic Effects of Prescribed Burning: A Case Study. USDA Forest Service RN-RM-415, Rocky Mtn. For. and Range Exp. Stn., Fort Collins, Colorado. pp. 5.

Bacon, W.R. and A.D. Twombly. . National Forest Landscape Management USDA Forest Service Agriculture Handbook No. 559. Washington, DC.

Balmer, W.E. 1976. Alternatives to Prescribed Burning. Proceedings: Fire by Prescription Symposium, Atlanta, Geogia. pp. 99-100.

Bethea, J.M. 1976. Public Understanding of Prescribed Fires and It's Effects. Proceedings: Fire by Prescription Symposium. Atlanta, Georgia. pp.113-114.

Byram, G.M. and R.M. Nelson. 1952. Lethal Temperatures and Fire Injury. USDA Forest Service, RN-1, Southeastern For. Exp. Stn., Asheville, North Carolina.

Connaughton, C.A. 1972. The Impacts of Fire on Forest Values and Services Other Than Wood Production. USDA Forest Service, Denver, Colorado. 151 pp.

Cooper, C.F. 1961b. Pattern in Ponderosa Pine Forests. Ecology 42:493-499.

Cross, R.D. and R.W. Wales, ed. 1974. Atlas of Mississippi. University Press of Mississippi. Jackson, Mississippi. 187pp.

Cumming, J.A. 1969. Prescribed Burning on Recreation Areas in New Jersey: History, Objectives, Influence, and Technique. Tall Timbers Fire Ecology Conference Proceedings, 9:251-269.

Cushwa, C.T., M. Hopkins, B.S. McGinnes. 1971. Soil Movement in Established Gullies After a Single Prescribed Burn in the South Carolina Piedmont. USDA Forest Service RN-SE-153. Asheville, North Carolina. 4pp.

Daniel, T.C. and R.S. Boster. 1976. Measuring Landscape Esthetics: The Scenic Beauty Estimation Method. USDA For. Ser. Res. Paper RM-167, Rocky Mtn. For. and Range Exp. Stn., Fort Collins, Colorado. 65 pp.

Daniel, T.C., E.H. Zube, and B.L. Driver (Tech. Cords.). 1979. Assessing Amenity Resource Values. USDA Forest Service GTR-RM-68. 70 pp.

Davis, L.S. and R.W. Cooper. 1963. How Prescribed Burning Affects Wildlife Occurence. J. For. 61:915-917.

Douglass, J.E. and D. H. VanLear. 1983. Prescribed Burning and Water Quality of Ephemeral Streams in the Piedmont of South Carolina. Forest Sci. 29(1):181-189.

Dube, D.E. 1982. Fire Management Activities in Canadian National Parks: An Overview. Fire and It's Field Effects: Proceeding of the Symposium. Jackson, Wyoming. The Intermountain Fire Council; Pierre, South Dakota: The Rocky Mountain Fire Council. pp 57-59.

Ebert, D.J. 1978. Basic Management Plan for Turkey Fork Reservoir, Perry County, County Mississippi (1978-1990). USDA Forest Service unpublished paper. Laurel, Mississippi. 6pp.

Evans, W.G. 1971. The Attraction of Insects to Forest Fires. Tall Timbers Conference on Animal Control by Habitat Management Proceedings. pp. 115-127.

Fischer, W.C. 1984. Wilderness Fire Management Planning Guide. USDA For. Ser. Gen. Tech. Rep. INT-171, Inter. For. and Range Exp. Stn., Ogden, Utah. 43pp.

Gaidula, P. 1983. Training in Support of Park and Wilderness Fire Management Programs. Proceedings: Wilderness Fire Sysmposium, Missoula, Montana. pp 220-224.

Gardner, M.C. and W.N. Melhorn. 1979. Systematic Methodology to Numerically Evaluate Scenic Factors of Landscape: Application to Tippecanoe County, Indiana. Purdue University, Water Resources Council Tech. Rep. 110. 195 pp.

Garren, K.H. 1939. Effects of Fire on Vegetation of the Southeastern United States. The Botanical Review 9:617-654.

Hall, J.A. 1972. Forest Fuels, Prescribed Fire, and Air Quality. USDA Forest Service, Pacific Northwest For. and Range Exp. Stn., Portland, Oregon. 44 pp.

Hartman, H.E. 1974. Forestland Fire: Industry's Enemy and Management Ally. Proceedings: Tall Timbers Fire Ecology Conference, Portland, Oregon. 15:127-133.

Heinselman, M. 1973. Fire in the Virgin Forests of the Boundary Waters Canoe Area. Quanternary Research 3(3):329-382.

Hendrickson, W.H. 1972. Fire in the National Parks Symposium, Tall Timbers Fire Ecology Conference No. 12. pp. 339-343.

Huck, C. 1985. Burning the Wilderness. Am. Forests. 91(8):13-16,55.

Hughes, R.H. and F.E. Knox. 1964. Response of Gallberry to Seasonal Burning RN-SE-21, USDA Forest Service Southeastern For. Exp. Stn., Asheville, North Carolina. pp. 1.

Humpreys, F.R. and F.G. Craig. 1981. Effects of Fire on Soil Chemical, Structural and Hydrological Properties. Australian Academy of Science, Canberra, Australia. 24 pp.

Jones, L. (moderator). 1974. Are Current Fire Management Activities Compatible with Park and Wilderness Values: A Panel Discussion. Proceedings: Tall Timbers Fire Ecology Conference, Missoula, Montana. 14:167-180.

Kautz, E.W. 1987. Prescribed Fire in Blueberry Management. U.S. Forest Service Fire Management Notes, USDA Forest Service, Washington DC, Vol.48, Number 3.

Kilgore, B.M. 1974. Fire Management in the National Parks: An Overview. Proceedings: Tall Timbers Fire Ecology Conference, Missoula, Montana. 14:45-57.

Kilgore, B.M. 1976. From Fire Control to Fire Management: An Ecological Basis for Policies. Forty-first North American Wildlife Conference, Washington, DC. pp. 477-493.

Kilgore, B.M. 1983. Planned Ignitions in Wilderness: A Response to Bill Worf. USDA Forest Service GTR-182, Inter. For. and Range Exp. Stn., Ogden, Utah. pp. 283-285.

Komarek, E.V. 1982. Economic and Environmental Evaluation of Prescribed Burning and Alternatives. USDA Forest Service Southern Region 192 pp.

Langdon, O.G. 1981. Some Effects of Prescribed Fire on Understory Vegetation in Loblolly Pine Stands. Proceedings: Prescribed Fire and Wildlife in Southern Forests Symposium, Myrtle Beach, South Carolina, Belle W. Baruch Forest Science Institute of Clemson University, Georgetown, South Carolina. pp. 143-153.

Lewis, C.E. and T.J. Harshbarger. 1976. Shrub and Herbaceous Vegetation After 20 Years of Prescribed Burning in the South Carolina Coastal Plain. J. Range Man. 29(1):13-18.

Lotti, T., R.A. Klawitter, W.P. LeGrande. 1960. Prescribed Burning for Understory Control in Loblolly Pine Stands of the Coastal Plain. USDA Forest Service, STN-116, Southeastern For. Exp. Stn., Asheville, North Carolina. 19pp.

Lutz, H.J. 1956. Ecological Effects of Forest Fires in the Interior of Alaska. USDA Tech. Bull. No. 1133. 212 pp.

Lyon, L.J., H.S. Crawford, E. Czuhai, R.L. Fredriksen, R.F. Harlow, L.J. Metz, H.A. Pearson. 1978. Effects of Fire on Fauna. USDA Forest Service GTR-WO-6. 22pp.

Meskimen, G. 1971. Managing Forest Landscapes: Is Prescribed Burning in the Picture. Prescribed Burning Sysmposium Proceedings, Charleston, South Carolina, USDA Forest Service, Southeastern Forest Exp. Stn., Asheville, North Carolina. pp. 54-58.

Metz, L.J. and M.H. Farrier. 1973. Prescribed Burning and Populations of Soil Mesofauna. Environ. Entomol. 2:433-440.

Mobley, H.E. and E. Kerr. 1973. Wildfire Versus Prescribed Fire in the Southern Environment. USDA Forest Service, Atlanta, Georgia. 6 pp.

Montgomery, J.M. 1976. The Public Looks at Prescribed Fire. Proceedings: Fire by Prescription Symposium. Atlanta, Georgia. pp 115-116.

Mutch, R.W. and K.M. Davis. 1983. Visitor Protection in Parks and Wilderness: Preventing Fire-Related Accidents and Disasters. Proceedings: Wilderness Fire Symposium, Missoula, Montana. pp.149-158.

Omni, P.N. and R.D. Lavin. 1982. Prescribed Fire Impacts on Recreational Wildlands: A Status Review and Assessment of Research Needs. Eisenhower Consortium for Western Environmental Forestry Research, USDA Forest Service, Rocky Mtn. For. and Range Exp. Stn., Fort Collins, Colorado. pp.18.

Orr, H.R. 1976. Consideration in Use of Fire by Prescriptions for Managing Visual Resources. Proceedings: Fire by Prescription Symposium, Atlanta, Georgia. pp 43.

Perkins, C.J. 1971. The Effects of Prescribed Burning on Outdoor Recreation. Prescribed burning Symposium Proceedings, Charleston, South Carolina, USDA Forest Service Southeastern For. Exp. Stn. Asheville, North Carolina. pp. 59-63.

Perkins, C.J. 1976. Public Understanding of Prescribed Fire and Its Effects. Proceedings: Fire by Prescription Symposium. Atlanta, Georgia. pp. 117-118.

Phillips, J. 1965. Fire as Master and Servant: Its Influence in the Bioclimatic Regions of Trans-Saharan Africa. Tall Timbers Fire Ecology Conference Proceedings No. 4. pp 7-109.

Pritchett, W.L. 1976. Considerations in Use of Fire by Prescription for Managing Soil and Water. Proceedings: Fire by Prescription Symposium. Atlanta, Georgia. pp. 33-35.

Rauw, D.W. 1980. Interpreting the Natural Role of Fire: Implication for Fire Management Policy. Proceedings 6th Conference on Fire and Forest Meteorology, Society of American Foresters, Washington, DC. pp. 228-233.

Richter, D.D. and C.W. Ralston. 1982. Prescribed Fire: Effects on Water Quality and Forest Nutrient Cycling. Science, 215(5):661-663.

Sandberg, D.V., J.M. Pierovich, D.G. Fox, E.W. Ross. 1979. Effects of Fire on Air. USDA Forest Service, GTR-WO-9. 40pp.

Sandberg, D.V. and D.E. Ward. 1981. Air Quality Considerations in Using Prescribed Fire for Weed Control. Proceedings: John S. Wright Forestry Conference, West Lafayette, Indiana, USDA Forest Service PNW For. and Range Exp. Stn., Seattle, Washington. pp. 237-247.

Simpson, C.J., T.L. Rosenthal, T.C. Daniel, and G.M. White. 1976. Social Influence Variations in Evaluating Managed and Unmanaged Forest Areas. J. Appl. Psychol. 61:759-763.

Silker, T.H. 1961. Prescribed Burning to Control Undesirable Hardwoods in Southern Pine Stands. Texas Forest Service Bulletin 51. 44 pp.

Stankey,G.H. 1976. Wilderness Fire Policy: An Investigation of Visitor Knowledge and Beliefs. RP-INT-180 USDA Forest Service Inter. For, and Range Exp. Stn., Ogden, Utah. 17pp.

Stoddard, H.L. 1935. Use of Controlled Fire in Southeastern Upland Game Management. J. For. 33:346-351.

Stoddard, H.L. Sr. 1963. Bird Habitat and Fire. Tall Timbers Fire Ecology Conference Proceedings No. 2 pp.163-175.

Stone, E.L. 1971. Effects of Prescribed Burning on Long-Term Productivity of Coastal Plain Soils. USDA Forest Service, Southeastern For. Exp. Stn. Prescribed Burning Symposium, Charleston, South Carolina. pp. 115-127.

Taylor, J.G. and T.C. Daniel. 1982. Scenic and Recreational Perceptions of Forest Burn Areas and the Effects of Fire Information on Public Knowledge and Attitude. Paper prepared for USDA Forest Service Eisenhower Consortium, Ref. No. RM-80-102-612 (EC-343), University of Arizona, Tuscon, Arizona. 158pp.

Taylor, J.G. and T.C. Daniel. 1984. Prescribed Fire: Public Education and Perception. J. For. 82(6):361-365.

Tikkala, W.R. 1976. Symposium Fire by Prescription Panel, Public Understanding of Prescribed Fire and Its Effects. Proceedings: Fire by Prescription Symposium. Atlanta, Georgia. pp. 121-122.

Towle, E.L. 1983. Fire Management Policy and Programs for National Forest Wilderness. Proceedings: Wilderness Fire Symposium. Missoula, Montana. pp.49-50.

VanLear, D.H. and V.J. Johnson. 1983. Effects of Prescribed Burning in the Southern Appalachian and Upper Piedmont Forests: A Review. Forestry Bulletin No. 36, Clemson University Department of Forestry, Clemson, South Carolina 8 pp.

Vogl, R.J. 1967. Controlled Burning for Wildlife in Wisconsin. Tall Timbers Fire Ecology Conference Proceedings No. 6. pp. 47-96.

Wells, C.G. 1971. Effects of Prescribed Burning on Soil Chemical Properties and Nutrient Availability. Proceedings: Prescribed Burning Symposium. USDA Forest Service. pp. 86-99.

Wells, C.G., R.E. Capbell, L.F. DeBano, C.E. Lewis, R.L. Fredericksen, E.C. Franklin, R.C. Freelich, P.H. Dunn. 1979. Effects of Fire on Soil. USDA Forest Service GTR-WO-7.

Wright, H.A., F.M. Churchill, W.C. Stevens. 1982. Soil Loss, Runoff, and Water Qaulity of Seeded and Unseeded Steep Watersheds Following Prescribed Burning. J. Range Mgmt. 35(3):382-385.

_____ . 1982. Prescribed Fire Management in the Southern Region. USDA Forest Service, Sothern Region, Aviation and Fire Management. 134 pp.

_____ . 1985. Land and Resource Management Plan, National Forests in Mississippi. USDA Forest Service, Southern Region, Jackson, Mississippi 328 pp.